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Via Email and Overnight Service

June 30, 2014

Samuel Unger
Executive Officer
California Regional Water Quality Control Board –
Los Angeles Region
320 W. Fourth Street, Suite 200
Los Angeles, California 90013

Re: *Former Kast Property, Case No. SCP 1230 – Submission of the Revised Remedial Action Plan and Associated Documents*

Dear Executive Officer Unger:

On behalf of Shell Oil Company and Shell Oil Products US (collectively "Shell"), the Revised Remedial Action Plan, Revised Human Health Risk Assessment ("HHRA") Report and Revised Feasibility Study are being submitted to the Regional Water Quality Control Board – Los Angeles Region ("Regional Board") today. While Shell believes the Remedial Action Plan, HHRA Report and Feasibility Study originally submitted on March 10, 2014 proposed a remedial approach that would address the environmental conditions in the Carousel neighborhood and protect the Carousel residences, Shell and its consultants have revised these documents to address the comments and directives contained in the Regional Board's April 30, 2014 letter.

These documents were prepared using well-accepted and established scientific guidance and protocols, including the guidance documents specified by the Regional Board in the Cleanup and Abatement Order for this site. The analyses contained in these documents are based on the extensive testing data from the residential properties and public rights-of-way in and adjacent to the Carousel neighborhood (including over 11,000 soil samples, 2,700 soil vapor samples and 2,400 indoor and outdoor air samples). Testing has been performed at 95% of the Carousel homes and has been completed at over 80% of the homes. While Shell continues to conduct outreach to schedule testing at the remaining homes, the extensive and robust data obtained so far provide a solid foundation upon which to base the selected remedial approach.

To summarize the findings from Shell's investigation of the conditions in the Carousel neighborhood:

- Based on the testing data, the Los Angeles County Health Department and the Regional Board have all concluded that there is no exposure in the neighborhood that poses an imminent health risk or explosion hazard.
- Results from sampling of indoor and outdoor air and sub-slab soil vapor have shown that vapor intrusion from sub-slab soil vapor to indoor air is not occurring to any measurable extent in homes.
- Groundwater monitoring has revealed the presence of groundwater impacts beneath the site that are generally limited to the shallow zone. The groundwater plume is stable and/or decreasing and has not migrated offsite to any significant extent. The drinking water in the Carousel neighborhood, which does not come from groundwater in the shallow zone, is safe. California Water Service Company regularly tests community drinking water, and has confirmed that the water meets the applicable drinking water quality standards.
- Soil impacts exist at many of the properties in the Carousel neighborhood. These impacts do not pose an imminent health risk. Using very conservative, health-protective standards, the remedial approach proposed in the Remedial Action Plan fully addresses the potential for exposure to impacted shallow soils at residential properties.

In light of these findings and based on the data and the applicable scientific guidance and protocols, the Revised **Remedial Action Plan** proposes the following steps:

- Excavation of shallow soils from the yards at residential properties will be conducted at properties where Remedial Action Objectives based on unrestricted land use are not met under existing conditions. Excavation will be conducted in both landscaped and hardscaped areas of residential yards, excluding beneath City sidewalks and streets, to a depth of 5 feet below ground surface ("bgs"). The excavation will also remove residual concrete slabs if encountered within the depth excavated.
- Because residents cannot excavate below 3 feet without obtaining a permit, the possibility of exposure to soils remaining below 3 feet bgs is currently controlled by existing ordinances. The proposed excavation to 5 feet bgs is to satisfy the Board's concerns about residents excavating below 3 feet without getting a permit. The Revised Remedial Action Plan explains how notifications, management, and handling of residual soils that are impacted by COCs will limit exposures to deeper soils.
- In order to address the Board's desire to remove a greater amount of mass more quickly to minimize potential impacts to groundwater, Shell also proposes targeted deeper excavation of soils from 5 to 10 feet bgs at specific properties where data analysis and modeling indicate that concentrations exceed 10 times the site-specific cleanup goals ("SSCGs") for total petroleum hydrocarbons. Soil vapor extraction ("SVE") and

bioventing will be used to address petroleum hydrocarbons and VOCs in residual soils and soil vapor, and methane in soil vapor. SVE wells will be installed in City streets and on certain residential properties, as appropriate to ensure adequate coverage.

- Bioventing will be conducted via cyclical operation of SVE wells to increase oxygen levels in subsurface soils and promote microbial activity and degradation of longer-chain petroleum hydrocarbons.
- Extensive testing at the site shows that vapor intrusion does not appear to be impacting indoor air. However, as an additional protective measure, sub-slab mitigation will be implemented at 28 properties based on sub-slab soil vapor data. In addition, Shell is prepared to offer installation of a sub-slab mitigation system to any of the homeowners in the Carousel neighborhood to alleviate concerns about potential impacts to their indoor air from the site.
- LNAPL will continue to be recovered where it has accumulated in monitoring wells to the extent technologically and economically feasible, and where a significant reduction in current and future risk to groundwater will result.
- Compounds in groundwater will be reduced to the extent technologically and economically feasible via source reduction and monitored natural attenuation. Groundwater monitoring will continue as part of remedial actions. Monitored natural attenuation could be paired with contingency groundwater remediation of oxidant injection in areas where Site-related COCs exceed 100x MCL if, after a five-year review following start of SVE/bioventing operations, the groundwater plume is not stable or decreasing. In addition, upgradient sources would need to be addressed by the overseeing agencies.

Shell believes that this approach accomplishes the remedial objectives set forth in the Revised Site-Specific Cleanup Goals Report, protects the health and safety of the Carousel residents, minimizes the inconvenience to the residents and surrounding communities, sets in place a long-term groundwater protection plan, achieves the SSCGs, and, importantly, preserves the integrity of the neighborhood.

Along with the Revised Remedial Action Plan, Shell is submitting a Revised Feasibility Study and a Revised HHRA Report. The Revised **Feasibility Study** analyzes and compares in detail the selected approach along with a number of possible alternative approaches, and weighs each alternative against the goals of reducing potential exposures to residents, protecting groundwater quality, preserving the neighborhood and the other factors set forth in the Cleanup and Abatement Order for the Carousel neighborhood, State Water Board Resolution No. 92-49, and other applicable regulations.

The Revised **HHRA Report** applies the Site-Specific Cleanup Goals to the extensive testing data that Shell has obtained from the Carousel residences, and the results of this analysis was used to determine what specific work needs to be done at each of the Carousel residences.

The next step is for the Regional Board and the other involved agencies to review the Revised Remedial Action Plan. It will then be made available for public comment and a simultaneous public comment period will occur as part of the environmental review required by the California Environmental Quality Act that the Regional Board has undertaken with Shell's support. Once a Final Environmental Impact Report is issued and adopted, the Revised Remedial Action Plan receives final approval from the Regional Board, the necessary permits for the work have been issued and access is granted, the remedial work in the Carousel neighborhood will begin. Shell plans to meet with the homeowners and residents at individual properties (and their legal representatives) where work will be performed to explain the property specific remedial plan, answer questions, gather information that will be used in arranging alternative accommodations during the work, and schedule the work.

Shell looks forward to continuing to work with the Regional Board and is committed to moving forward with implementing this Revised Remedial Action Plan as soon as possible.

Sincerely,

Douglas Weimer
Sr. Principle Program Manager
Shell Oil Products US

Enclosures

REVISED REMEDIAL ACTION PLAN

REVISED REMEDIAL ACTION PLAN

FORMER KAST PROPERTY
CARSON, CALIFORNIA

Prepared for

Shell Oil Products US
20945 S. Wilmington Avenue
Carson, California 90810

June 30, 2014

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REVISED REMEDIAL ACTION PLAN

FORMER KAST PROPERTY
CARSON, CALIFORNIA
Site Cleanup No. 1230
Site ID 2040330
Cleanup and Abatement Order No. R4-2011-0046

This Revised Remedial Action Plan (Revised RAP) for the former Kast Property was prepared on behalf of Equilon Enterprises LLC, doing business as Shell Oil Products US (Shell or SOPUS), by URS Corporation (URS) and Geosyntec Consultants, Inc. (Geosyntec). URS prepared the majority of this document, including Sections 1 through 5, most of Section 8 and Sections 9 and 10; Geosyntec prepared Sections 6 and 7 and the sub-slab mitigation, bioventing, and groundwater portions of Section 8. This Revised RAP is being submitted in response to Cleanup and Abatement Order No. R4-2011-0046 issued by the California Regional Water Quality Control Board, Los Angeles Region (RWQCB or Regional Board) on March 11, 2011, the RWQCB's letter dated January 23, 2014 directing Shell to submit a Remedial Action Plan and Human Health Risk Assessment pursuant to California Water Code Section 13304, and the Regional Board's letter dated April 30, 2014 and attachments that provided review comments on the RAP, Feasibility Study (FS), and Human Health Risk Assessment (HHRA) dated March 10, 2014.

The scope of services performed in preparation of this RAP may not be appropriate to satisfy the needs of other users, and any use or reuse of this document or the information contained herein is at the sole risk of said user. No express or implied representation or warranty is included or intended in this Revised RAP or the companion Revised FS and HHRA except that the work was performed within the limits prescribed by the client with the customary thoroughness and competence of professionals working in the same are on similar projects. This report was prepared under the technical direction of the undersigned.

URS Corporation

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June 30, 2014

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CERTIFICATION
REVISED REMEDIAL ACTION PLAN

FORMER KAST PROPERTY
CARSON, CALIFORNIA

I am the Senior Project Manager for Equilon Enterprises LLC, doing business as Shell Oil Products US, for this project. I am informed and believe that the matters stated in the this Revised Remedial Action Plan for the former Kast Property, Carson, California are true, and on that ground I declare, under penalty of perjury in accordance with Water Code section 13267, that the statements contained therein are true and correct.

Douglas Weimer
Sr. Principle Program Manager
Shell Oil Products US
June 30, 2014

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LIST OF ACRONYMS AND ABBREVIATIONS

1:1 H:V	One horizontal to one vertical
ARARs	Applicable or relevant and appropriate requirements
ASP	Activated sodium persulfate
ASTM	American Society for Testing and Materials
ASTs	Aboveground storage tanks
Bbls	Barrels of oil (= 42 US gallons)
bgs	Below ground surface
BHC	Barclay Hollander Corporation
BMPs	Best management practices
BTEX	Benzene, toluene, ethylbenzene, xylenes
Cal-EPA	California Environmental Protection Agency
Cal/OSHA	State of California – Division of Occupational Safety and Health
Cal-Water	California Water Services Company
CAO	Cleanup and Abatement Order
CCR	California Code of Regulations
CDOGGR	California Division of Oil, Gas and Geothermal Resources
CDWR	California Department of Water Resources
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cm	Centimeters
CO_2	Carbon dioxide
COCs	Constituents of Concern
COPCs	Constituents of Potential Concern
CWS	California Water Services Company
cy	Cubic yard
dB	Decibel
DBS	Department of Building and Safety
DIPE	Diisopropyl ether
Dole	Dole Foods Company
DPW	Department of Public Works
DTSC	Department of Toxic Substances Control
EIR	Environmental Impact Report
EPCs	Exposure point concentrations
ESLs	Environmental Screening Levels
FEMA	Federal Emergency Management Agency
FID	Flame ionization detector
FORCO	Fletcher Oil and Refining Company
FS	Feasibility Study
ft	Foot or feet
g	Grams
GAC	Granular activated carbon
Geosyntec	Geosyntec Consultants, Inc.
HAZWOPER	40-Hour hazardous waste operations
HHRA	Human Health Risk Assessment
HI	Hazard Index

HQ	Hazard quotient
HSC	Health and Safety Code
HSP	Health and Safety Plan
HSAA	Hazardous Substances Account Act
ILCR	Incremental lifetime cancer risk
in/sec	Inches per second
in-Hg	Inches of mercury
in-WC	Inches water column
IRAP	Interim Remedial Action Plan
ISCO	In-situ chemical oxidation
JSAs	Job Safety Analyses
L	Liter
LA	Los Angeles
LACDPW	Los Angeles County Department of Public Works
Landtec	Landtec GEM 2000
lb	Pound
LEL	Lower explosive limit
LNAPL	Light non-aqueous phase liquid
m	Meter
MCLs	Maximum Contaminant Levels
met station	Meteorological station
mg/kg	Milligrams per kilogram
mph	Miles per hour
msl	Mean sea level
MTA	Los Angeles County Metropolitan Transportation Authority
NAAQS	National Ambient Air Quality Standard
NAPL	Non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NELAP	National Environmental Laboratory Accreditation Program
NIOSH	National Institute for Occupational Safety and Health
NLs	Notification Levels
O_3	Ozone
O&M	Operations and maintenance
OD	Outer Diameter
OEHHA	Office of Environmental Health Hazard Assessment
OES	State of California Governor's Office of Emergency Services
OSHA	Occupational Safety and Health Administration
OTC	Oil Transportation Company
OVA	Organic vapor analyzer
PAHs	Polycyclic aromatic hydrocarbons
PCE	Tetrachloroethene
PEL	Permissible Exposure Limit
PID	Photoionization detector
PM10	Particulate matter with an aerodynamic diameter of 10 microns or less
PPE	Personnel protection equipment
ppm	Parts per million
PPP	Public Participation Plan
PSE	Pacific Soils Engineering, Inc.

PSI	Pounds per square inch
PSIG	Pound-force per square inch gauge
PSRP	Property-specific Remediation Plan
PVC	Polyvinyl chloride
RAP	Remedial Action Plan
RAOs	Remedial Action Objectives
RDIP	Remedial Design and Implementation Plan
Regional Board	Regional Water Quality Control Board
RI	Risk Index
ROVI	Radius of vacuum influence
RQs	Reportable Quantities
RWQCB	Regional Water Quality Control Board
SCAQMD	South Coast Air Quality Management District
scfm	Standard cubic feet per minute
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SIM	Selected Ion Monitoring
Site	Former Kast Property, Carson, California
SOD	Soil oxidant demand
SOPUS	Shell Oil Products United States
SP	Sodium persulfate
SSCGs	Site-specific cleanup goals
SSD	Sub-slab depressurization
SSO	Site Safety Officer
SVE	Soil vapor extraction
SVOCs	Semi-volatile organic compounds
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TBA	Tert-butyl alcohol
TCE	Trichloroethene
THMs	Trihalomethanes
TPH	Total petroleum hydrocarbons
TPHd	Total petroleum hydrocarbons as diesel
TPHg	Total petroleum hydrocarbons as gasoline
TPHmo	Total petroleum hydrocarbons as motor oil
UEL	Upper explosive limit
URS	URS Corporation
USA	Underground Service Alert
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USTs	Underground storage tanks
VdB	Root mean square velocity in decibels
VEW	Vapor extraction well
VOCs	Volatile organic compounds
VPH	Volatile petroleum hydrocarbons
WRD	Water Replenishment District of Southern California
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
$\mu g/m^3$	Micrograms per cubic meter
%	Percent

EXECUTIVE SUMMARY

This Revised Remedial Action Plan (Revised RAP) for the former Kast Property (Site) in Carson, California was prepared by URS Corporation (URS) and Geosyntec Consultants, Inc. (Geosyntec) on behalf of Equilon Enterprises LLC, doing business as Shell Oil Products US (Shell or SOPUS) in accordance with Cleanup and Abatement Order (CAO) No. R4-2011-0046 issued to Shell by the California Regional Water Quality Control Board – Los Angeles Region (RWQCB or Regional Board) on March 11, 2011 and the RWQCB's letter dated January 23, 2014 directing Shell to submit a RAP and Human Health Risk Assessment (HHRA) pursuant to California Water Code Section 13304. A RAP, Feasibility Study (FS) and HHRA were timely submitted to the Regional Board on March 10, 2014 as directed in the RWQCB's January 23, 2014 letter. The Regional Board, along with the Office of Environmental Health Hazard Assessment (OEHHA) and UCLA Expert Panel reviewed these documents, and the Regional Board provided comments in its letter dated April 30, 2014. The April 30, 2014 letter directed Shell to submit a Revised RAP, FS, and HHRA addressing the RWQCB, OEHHA and the Expert Panel's comments and directives by June 16, 2014. Per the Regional Board's letter dated June 4, 2014, the submittal date was revised to June 30, 2014. This Revised RAP is being submitted in partial satisfaction of that directive. The Revised HHRA (Geosyntec, 2014c) and Revised FS (Geosyntec, 2014d) are being submitted concurrently as separate documents.

This Revised RAP, along with the Revised HHRA and Revised FS, were prepared to fully address the Regional Board's directives provided beginning on Page 15 of the April 30, 2014 letter. The Revised RAP summarizes the remedial alternative evaluation process provided in the companion Revised FS and identifies and describes recommended full-scale remedial actions for impacted shallow soil and other media at the Site in accordance with requirements of the CAO and directives in the Regional Board's January 23 and April 30, 2014 letters. The Revised RAP and the recommended remedy comply with applicable provisions of the California Health and Safety Code, California Water Code, and State Water Resources Control Board (SWRCB) Resolution 92-49, and in particular, the Regional Board and Expert Panel's comments on the previously submitted RAP dated March 10, 2014. A cross-reference table, included as Appendix A, summarizes where in the Revised RAP and companion Revised HHRA and Revised FS, comments and directives from the Regional Board's April 30, 2014 letter are addressed.

This Revised RAP and the companion HHRA and FS were prepared following extensive multimedia investigations at the Site from 2008 to present. Key assessment work completed at the Site includes:

- Assessment in public rights-of-way, the adjacent railroad right-of-way, and other non-residential areas including soil, soil vapor, groundwater, and outdoor air media;
- Assessment at 95% of the individual residential properties, including soil, sub-slab soil vapor, and indoor air testing;
- Assessment of environmental impact and feasibility of removal of residual concrete reservoir slabs;
- Pilot testing to evaluate different potential remedies for Site impacts, and

- Development of Site-Specific Cleanup Goals.

The Site has been impacted with petroleum hydrocarbons associated with crude oil storage during the period prior to residential redevelopment. Total petroleum hydrocarbon (TPH) impacts occur in shallow and deep soils together with volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs). VOCs, including benzene, and methane resulting from degradation of petroleum hydrocarbons are present in soil vapor[1]; dissolved-phase VOC and TPH impacts are present in groundwater, and LNAPL consisting of crude oil is locally present in the groundwater underlying a portion of the Site. In addition to hydrocarbon-related impacts, the Site is also locally impacted by chlorinated solvents, such as tetrachloroethene (PCE) and trichloroethene (TCE), and from a class of chlorinated compounds associated with potable water treatment referred to as trihalomethanes (THMs). Because THMs are related to residential water use, they are not considered constituents of concern (COCs) at the Site.

Some of these compounds, referred to as COCs, are present at concentrations that may pose an incremental cancer risk or human health hazard greater than the *de minimis* risk level of one in a million or Hazard Index greater than 1. Although it does not present a human health risk based on exposure, methane can potentially pose an explosion hazard where present in an enclosed space at a concentration between 5 and 15% in air and there is a source of ignition. In addition, concentrations for some COCs exceed criteria for the potential leaching to groundwater pathway.

A set of final recommended Site-Specific Cleanup Goals (SSCGs) was developed in the HHRA. SSCGs were developed for COCs in soil, soil vapor, and groundwater and are provided in Tables 5-1, 5-2 and 5-3 of this RAP. The Regional Board commented on certain of these SSCGs, and this Revised RAP has been modified to incorporate RWQCB-directed and approved SSCGs.

Medium-specific (i.e. soil, soil vapor, and groundwater) Remedial Action Objectives (RAOs) were developed. These RAOs include:

- Prevent human exposures to concentrations of COCs in soil, soil vapor, and indoor air such that total (i.e., cumulative) lifetime incremental cancer risks are within the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) risk range of one in one million to one hundred in one million (1×10^{-6} to 1×10^{-4}) and noncancer Hazard Indices are less than 1 or concentrations are below background, whichever is higher. Potential human exposures include onsite residents and construction and utility maintenance workers. For onsite residents, the lower end of the NCP risk range (i.e., 1×10^{-6}) and a noncancer Hazard Index less than 1 have been used.
- Prevent fire/explosion risks in indoor air and/or enclosed spaces (e.g., utility vaults) due to the accumulation of methane generated from the anaerobic biodegradation of petroleum

[1] Unless otherwise specified in this document, the term "soil vapor" is used to address both sub-slab and deeper soil vapor.

hydrocarbons in soils. Eliminate methane in the subsurface to the extent technologically and economically feasible.

- Remove or treat LNAPL to the extent technologically and economically feasible, and where a significant reduction in current and future risk to groundwater will result.

- Reduce COCs in groundwater to the extent technologically and economically feasible to achieve, at a minimum, water quality objectives in the Basin Plan to protect the designated beneficial uses, including municipal supply.

A further consideration is to maintain residential land-use of the Site and avoid displacing residents from their homes or physically dividing the established Carousel community.

The Revised FS identified and screened a range of remedial technologies potentially applicable to site cleanup. Remediation technologies were screened and then assembled into remedial alternatives that were subjected to initial screening and detailed evaluation for cleanup of the Site. Detailed evaluation conducted for the Revised FS included evaluation of costs associated with each of the alternatives considered and incremental costs vs. benefits of different alternatives in accordance with SWRCB Resolution 92-49. Estimates of mass proposed to be left in place and the basis for estimating the time and cost to reduce the concentrations of constituents of concern is detailed in the Revised FS and formed a part of the basis for selecting the recommended Alternative 4D. The estimated cost for the recommended remedy is $132 million. The detailed evaluation of alternatives, along with the April 30, 2014 comments and consideration of State Acceptance, led to selection of the following recommended alternative and multi-media remedial action approach:

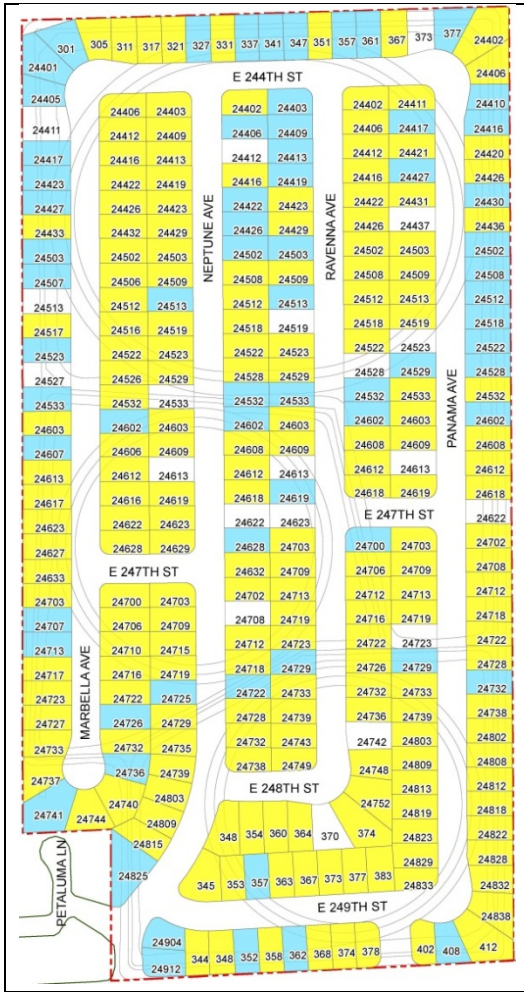
- Excavation of shallow soils from both landscaped and hardscaped areas of residential yards at impacted residential properties where RAOs are not met under existing conditions. Excavation will be conducted to a depth of 5 feet below ground surface (bgs) throughout the accessible areas of front and back yards at approximately 202 properties identified based on Site characterization data, the soil concentration contour maps, results of the HHRA, and where groundwater protection SSCGs are exceeded, subject to setbacks to protect structures and sensitive utilities. The excavation will also remove residual concrete slabs, to the extent practicable, if encountered within the depth excavated. The 202 properties identified for excavation to 5 feet bgs are shown on the figure on page ES-5:

- Excavation of deeper soils between 5 and approximately 10 feet bgs at approximately 82 properties where TPH concentrations exceed 10 times SSCGs or the residual NAPL soil concentration and significant hydrocarbon mass can be reduced based on the distribution and concentration of hydrocarbons detected. This targeted deeper excavation will be conducted where equipment access is feasible and excavation can be achieved safely, subject to allowable setbacks from structures and sensitive utilities. The 82 properties identified for targeted excavation from 5 to 10 feet bgs are shown on the figure on Page ES-5.

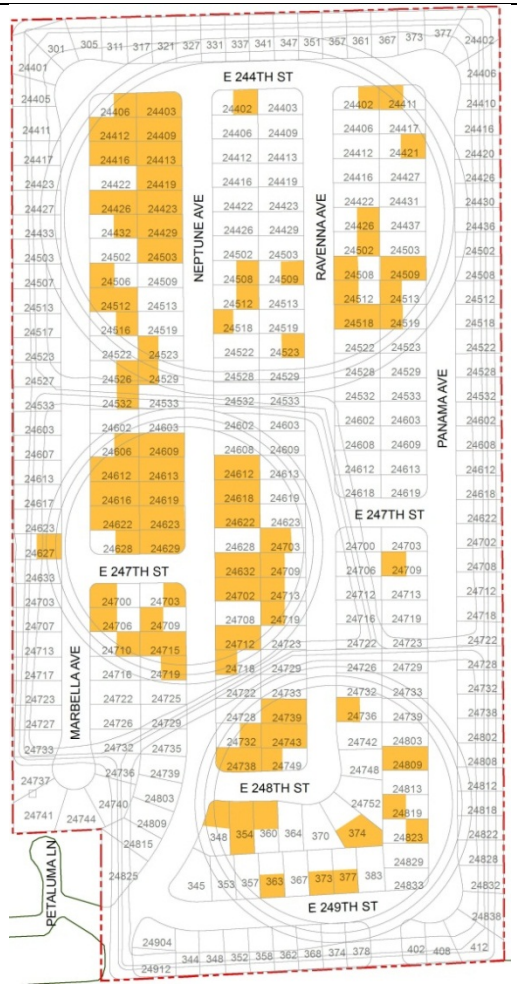
- Excavation may be accomplished using a variety of methods, including track-mounted excavators, backhoes, track-mounted limited access auger drill rigs, and by hand, where necessary. Specific equipment to be used will be identified in the Remedial Design and

Implementation Plan (RDIP) and in Property-specific Remediation Plans (PSRPs) to be developed after approval of the RAP.

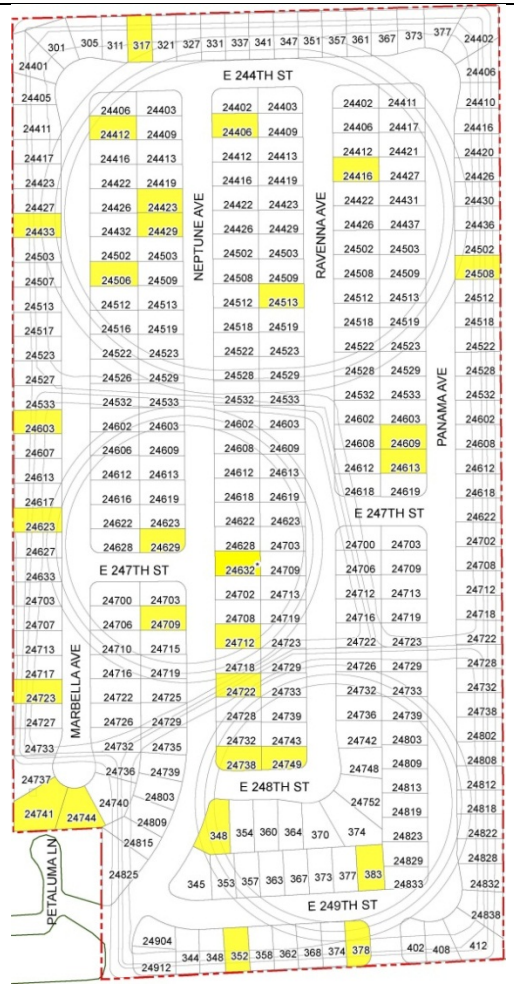
- The possibility of exposure to soils remaining below 5 feet bgs and impacted soils beneath City streets and sidewalks is addressed through existing institutional controls that require a Grading Permit be issued by the City of Carson for excavations deeper than 3 feet and a Surface Containment and Soil Management Plan to address notifications, management, and handling of residual soils that are impacted by COCs at concentrations greater than risk-based levels. This plan is included in Appendix C.
- Shell will implement a community outreach program to inform and educate residents in the community of residual impacted soils and of the notification procedures for management of these materials via the Surface Containment and Soil Management Plan.
- Following excavation, a combination of soil vapor extraction (SVE) and bioventing will be used to address residual petroleum hydrocarbons and VOCs in soils below the depth of excavation and areas not excavated. Soil vapor, including methane, will be addressed by active extraction using SVE and subsequent treatment by promoting degradation of residual hydrocarbon concentrations via bioventing where RAOs are not met following shallow soil excavation. SVE wells will be installed in City streets and on approximately 221 residential properties, as appropriate.
- Bioventing will be conducted via cyclical operation of SVE wells to increase oxygen levels in subsurface soils and promote microbial activity and degradation of longer-chain petroleum hydrocarbons. The same wells will be used for SVE and bioventing through cyclical operation of SVE, which will enhance oxygen flow to the subsurface to promote biodegradation of hydrocarbons during periods when SVE is not active. If intermediate products are generated from biodegradation of hydrocarbons, they will be removed via SVE operation and treated in the SVE treatment system.
- Sub-slab mitigation will be implemented at 28 properties where RAOs are not met and calculated vapor intrusion risk is greater than 1×10^{-6} calculated using an attenuation factor of 0.002 or methane concentrations in sub-slab soil vapor exceed the upper RAO for methane of 0.5%. The 28 locations where sub-slab mitigation systems will be installed are shown on the figure on Page ES-5. In addition, while the data do not indicate that vapor intrusion is an issue at any of the residences, Shell is prepared to offer installation of a sub-slab mitigation system to any of the homeowners in the Carousel neighborhood to alleviate concerns about potential impacts to their indoor air from the Site.



Properties identified for excavation to 5 ft bgs shown in (yellow)
Properties shown in blue not excavated; Properties shown in white not investigated
(see Figure 6-1 for details)



Properties identified for targeted excavation from 5 to 10 feet bgs shown in Orange
(see Figure 6-3 for details)



Properties identified for sub-slab mitigation as part of remediation shown in yellow
(see Figure 6-4 for details)

- LNAPL will be recovered where LNAPL has accumulated in monitoring wells MW-3 and MW-12 and in additional wells if it accumulates at a measurable thickness to the extent technologically and economically feasible, and where a significant reduction in current and future risk to groundwater will result. The goal for LNAPL recovery will be an end point of no measurable LNAPL accumulation in monitoring wells at the Site.
- COCs in groundwater will be reduced to the extent technologically and economically feasible via source reduction and monitored natural attenuation (MNA). MNA could be paired with contingency groundwater remediation of oxidant injection in areas where Site-related COCs exceed 100x MCL if, after a five-year review following start of SVE/bioventing operations, the groundwater plume is not stable or decreasing. In addition, upgradient sources would need to be addressed by the overseeing agencies.
- The recommended remedy includes a comprehensive long-term monitoring plan that will include monitoring of:
    - Sub-slab soil vapor probes at properties scheduled for remedial excavation until the SVE/bioventing system becomes operational and periodically thereafter;
    - Select soil vapor probe locations in City streets until the SVE/bioventing system becomes operational; thereafter, monitoring will be conducted at newly installed shallow and multi-depth soil vapor probes;
    - Utility boxes and other Site features previously monitored until the SVE/bioventing system becomes operational;
    - SVE/bioventing system operations and maintenance (O&M) and system effectiveness sampling will be conducted periodically.

For at the 202 locations where soils will be excavated to 5 feet bgs, 82 locations identified for targeted deeper excavation, and at 28 locations where sub-slab depressurization will be conducted, potential exposures and potential nuisance concerns will be addressed in the short term. In addition, while the data do not indicate that vapor intrusion is an issue at any of the residences, Shell is prepared to offer installation of a sub-slab mitigation system to any of the homeowners in the Carousel neighborhood to alleviate concerns about potential impacts to their indoor air from the Site. Deeper soil, soil vapor, and groundwater risk reduction will be implemented over a longer period of time through SVE/bioventing and MNA. These remedial actions are intended to achieve the RAOs and the SSCGs for soil, soil vapor, and groundwater as directed in the Regional Board's Review of the Revised SSCG Report and Directive dated January 23, 2014, comments received on the March 10, 2014 HHRA, FS, and RAP on April 30, 2014, and in accordance with RWQCB-directed and corrected SSCGs.

Although there is no indication that there are any long-term health risks, water quality, or nuisance concerns caused by COCs associated with residual concrete slabs, residual concrete slabs will be removed where practicable and where they can be removed safely when encountered during excavation. SVE/bioventing would address any concerns at the Site related to impacted soils that may be associated with the residual reservoir slabs left in place.

Following approval of the RAP, a Site-wide Remedial Design and Implementation Plan (RDIP) will be prepared. The Site-wide RDIP will provide details on the design and implementation of the planned remedy, including excavation, SVE/bioventing, and sub-slab vapor mitigation activities. It will include detailed plans for installation of the site-wide components of the SVE/bioventing system. In addition, Property Specific Remediation Plans (PSRPs) will be prepared for each property where remedial work will occur that will present detailed plans for remedial activities on a property-by-property basis, including site restoration. Property owners will be consulted regarding scheduling and logistics, particularly regarding site restoration, including any necessary removal and replacement of hardscape and landscaping features.

A tentative schedule of actions to implement the RAP has been developed and is discussed in Section 9. Certain items, including agency review of the RDIP and PSRPs, review of grading plans and permit applications by the City of Carson, Los Angeles County Department of Public Works (LACDPW) and South Coast Air Quality Management District (SCAQMD), and obtaining access at the individual properties, may take longer than estimated and are outside the control of Shell and its consultants. Following agency approval of the RDIP and PSRPs, issuance of Grading Permits by the City of Carson and the Permit to Operate/Construct for the SVE/bioventing treatment system by the SCAQMD, and granting of access, the construction phase of Site remediation, including installation of the SVE/bioventing system is expected to take approximately 5.6 years. Following the active construction phase, operations and maintenance of the SVE/bioventing system will occur for approximately 30 to 40 years. SVE/bioventing system and other monitoring activities, as required, will occur for an estimated 30 to 40 years.

1.0 INTRODUCTION

1.1 REGULATORY BASIS

URS Corporation (URS) and Geosyntec Consultants, Inc. (Geosyntec) prepared this Revised Remedial Action Plan (Revised RAP) for the former Kast Property (Site) in Carson, California on behalf of Equilon Enterprises LLC, doing business as Shell Oil Products US (Shell or SOPUS) in accordance with Cleanup and Abatement Order (CAO) No. R4-2011-0046 issued to Shell by the California Regional Water Quality Control Board – Los Angeles Region (RWQCB or Regional Board) on March 11, 2011 and the RWQCB's letter dated January 23, 2014 directing Shell to submit a RAP and Human Health Risk Assessment (HHRA) pursuant to California Water Code Section 13304. URS and Geosyntec timely submitted a RAP, Feasibility Study (FS) and HHRA on March 10, 2014 in accordance with the Regional Board's January 23, 2014 directive. The Regional Board, along with the Office of Environmental Health Hazard Assessment (OEHHA) and UCLA Expert Panel, reviewed these documents, and the Regional Board provided comments in its letter dated April 30, 2014. The April 30, 2014 letter directed Shell to submit a Revised RAP, Revised FS, and Revised HHRA addressing the RWQCB, OEHHA and the Expert Panel's comments and directives by June 16, 2014. Per the Regional Board's letter dated June 4, 2014, the submittal date was revised to June 30, 2014. This Revised RAP is being submitted in partial satisfaction of that directive.

The Revised RAP and companion Revised HHRA (Geosyntec, 2014c) and Revised FS (Geosyntec, 2014d) are being submitted concurrently as separate documents. Preparation of these documents follows a series of environmental investigations performed by URS and Geosyntec on Shell's behalf in response to Section 13267 letters issued to SOPUS by the Regional Board on May 8 and October 1, 2008 and November 18, 2009, Section 13304 letter dated October 15, 2009, CAO R4-2011-0046 dated March 11, 2011, and directives contained in the Regional Board's letter of April 30, 2014. This Revised RAP is generally consistent with:

- California Health and Safety Code (HSC) Section 25356.1;
- California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) *Remedial Action Plan (RAP) Policy*, Guidance Document No. EO-95-007-PP;
- State Water Resources Control Board (SWRCB) Resolution 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304*;
- CAO No. R4-2011-0046; and
- The Regional Board's directives in its January 23, 2014 and April 30, 2014 letters to Shell.

Shell submitted a Revised Site-Specific Cleanup Goal Report (Revised SSCG Report) on October 21, 2013 (Geosyntec, 2013c) in response to the Regional Board's directive in its letter of August 21, 2013. The Regional Board reviewed the Revised SSCG Report, provided comments on the report on January 23, 2014, and directed Shell to use RWQCB-revised SSCGs for soil, soil vapor, and groundwater provided in Tables 1, 2, and 3 of the January 23 letter, respectively, in preparing the

RAP and HHRA. In the HHRA submitted on Shell's behalf by Geosyntec on March 10, 2014, Shell proposed modifications to certain of the soil SSCGs for total petroleum hydrocarbons (TPH) and VOCs to protect groundwater based on the Regional Board's 1996 *Interim Site Assessment & Cleanup* Guidebook (RWQCB, 1996a). The RWQCB did not concur with the proposed modifications and directed Shell to use the RWQCB-revised SSCGs in preparing the Revised RAP and Revised HHRA (RWQCB, 2014d) and provided corrections for the SSCGs for total petroleum hydrocarbons as motor oil (TPHmo) and benzene in subsequent correspondence (RWQCB, 2014e). The RWQCB-directed and approved SSCGs are presented in Tables 5-1 (Soil), 5-2 (Soil Vapor), and 5-3 (Groundwater) of this RAP and support unrestricted residential land use for the Site.

In accordance with the California Environmental Quality Act (CEQA), an Environmental Impact Report (EIR) is being prepared by the RWQCB as the lead agency. The EIR will analyze the potential environmental impacts associated with the recommended remediation alternative. In addition, elements of the selected remedy will require separate approvals and permits from various agencies, including the South Coast Air Quality Management District (SCAQMD), City of Carson, and Los Angeles County Department of Public Works (LACDPW; multiple divisions).

1.2 OBJECTIVES

The objectives of this Revised RAP are to summarize the remedial alternative evaluation process conducted during the Revised FS and identify and describe the recommended full-scale remedial actions for impacted shallow soil and other media at the Site in accordance with Section 3.c of the CAO and directives in the Regional Board's January 23, 2014 and April 30, 2014 letters. The Revised RAP, the companion Revised FS and the selected remedy comply with applicable provisions of the California HSC, California Water Code (CWC), and SWRCB Resolution 92-49, and in particular, the Regional Board and Expert Panel's comments on the previously submitted RAP dated March 10, 2014.

Specifically, Section 3.c of the CAO requires:

- A detailed plan for remediation of wastes in shallow soil that will incorporate the results from the soil vapor extraction (SVE) pilot test;
- A plan to address any impacted area beneath any existing paved areas and concrete foundations of the homes, if warranted;
- A detailed Surface Containment and Soil Management Plan;
- An evaluation of all available options including proposed selected methods for remediation of shallow soil and soil vapor;
- Continuation of interim measures for mitigation according to the Regional Board approved Interim Remediation Action Plan; and
- A schedule of actions to implement the RAP.

A cross-reference table, included as Appendix A, summarizes where in the Revised RAP and companion Revised HHRA and Revised FS, comments and directives from the Regional Board's April 30, 2014 letter are addressed.

The CAO also requires that a number of listed guidelines and policies be applied in preparing the RAP. These guidelines and policies were used in developing the SSCGs presented in the Revised SSCG Report (Geosyntec, 2013c). In particular, the CAO and subsequent Regional Board directives require that setting of site cleanup goals and evaluation and selection of remedial alternatives be based on technological and economic feasibility as prescribed in SWRCB Resolution 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304.* The Revised FS, presented under separate cover and summarized in Section 7 below, addresses this directive. Per the Regional Board's directive dated January 23, 2014, the Revised RAP and companion Revised FS include:

- An evaluation of remedial alternatives, including all technologies that were pilot tested. These alternatives, including Alternatives 3B and 4B identified in the Revised SSCG Report, were evaluated with respect to effectiveness, feasibility and cost.
- A Preliminary Relocation Plan for residents in the Carousel Tract during implementation of remedial actions at individual properties (included as Appendix D in this Revised RAP). Future revisions to the Preliminary Relocation Plan may be submitted to address the scope of the approved remedy.
- Soil remediation boundaries that are identified based on findings from the HHRA, updated concentration contour maps for select COCs (update of contour maps transmitted on April 29, 2011), SSCGs for protection of groundwater, and overall findings from comprehensive investigations completed at the Site.
- Addressing the residual concrete reservoir slabs consistent with the Regional Board's clarification letter dated February 10, 2014.
- A proposed Surface Containment and Soil Management Plan (provided in Appendix C) to address residual COCs that will be left in place following soil excavation.

1.3 PUBLIC REVIEW PROCESS

In accordance with the CAO, Shell prepared and submitted a draft Public Participation Plan (PPP) dated September 17, 2013 (SOPUS, 2013). As described in the CAO and in the PPP, "the RAP will be made available for public review for a minimum 30-day period to allow for public comment on proposed remedies." The Regional Board will hold a public meeting to advise the public regarding planned remedial actions as part of this review process. It is intended that the public comment period and public meeting for the RAP will be concurrent with the public comment period and public meeting to be conducted for the EIR to be prepared for the project.

1.4 ORGANIZATION OF THE RAP

The remainder of this RAP is organized as follows:

- **Section 2** provides Site background information.
- **Section 3** briefly summarizes previous investigations and their findings.
- **Section 4** provides a summary of pilot tests conducted and interim actions implemented at the Site.
- **Section 5** outlines Remedial Action Objectives (RAOs).
- **Section 6** provides a summary of the HHRA.
- **Section 7** summarizes the Feasibility Study conducted to evaluate remedial alternatives and recommend a preferred alternative.
- **Section 8** presents the proposed remedial actions for the Site.
- **Section 9** describes the planned Remedial Design and Implementation Plan (RDIP) process and provides an estimated schedule for implementation of the RAP.
- **Section 10** provides an overall summary of the RAP.
- **Section 11** lists references cited.

As noted above, a cross reference table showing where in the Revised RAP, Revised HHRA and Revised FS the Regional Board's, OEHHA's and Expert Panel's comments and directives from the April 30, 2014 letter to Shell were addressed is included as Appendix A.

2.0 SITE BACKGROUND

2.1 SITE HISTORY

The Kast Property is a former petroleum storage facility that was operated by a Shell Oil Company predecessor from the mid-1920s to the mid-1960s. The property was sold to real estate developers who redeveloped it into the Carousel Community residential housing tract in the late 1960s and early 1970s. Today the Site consists of approximately 44 acres occupied by 285 single-family residential properties and City streets collectively referred to as the Carousel Tract. The Site is located in the City of Carson in the area inclusive of Marbella Avenue on the west, Panama Avenue on the east, E. 244th Street on the north, and E. 249th Street on the south (Figure 2-1). The Site is bordered by the Los Angeles County Metropolitan Transportation Authority (MTA) railroad tracks to the north (formerly owned by the BNSF Railway Company), Lomita Boulevard to the south, residential properties of the Monterey Pines Community and industrial property of the former Turco Products Facility to the west, and residential properties to the east (Figure 2-2).

Detailed Site background information, including information on historical Site operations, onsite structures formerly present, Site demolition, and development was provided in the Plume Delineation Report (URS, 2010a) and the Site Conceptual Model (SCM, Geosyntec, 2010b), included as Appendix A to the Plume Delineation Report. The Site was not developed until 1923 when Shell Company of California purchased the 44-acre property from Mary Kast and constructed three oil storage reservoirs. Two of the reservoirs (the central and southern Reservoirs No. 5 and 6) had capacities of 750,000 barrels each, and the third reservoir (northern Reservoir No. 7) had a capacity of 2 million barrels. The reservoirs were partially in-ground and partially aboveground with earthen berms constructed using soils excavated from the belowground portions of the reservoirs. The reservoirs had wire-mesh reinforced concrete-lined floors and side walls, and were covered with wood frame roofs supported by wooden posts on concrete pedestals (URS, 2010a). The outer berms were 15 to 20 feet above surrounding grade, and the outer walls of the berms are believed to have been covered with asphalt. The oil storage reservoirs were primarily used to store crude oil. Historical records cited in the Plume Delineation Report (URS, 2010a) indicate that bunker oil or heavier intermediate refinery streams may also have been stored in the reservoirs at one time, but the time and quantity of bunker oil storage is unknown. There is no indication that the reservoirs were used to store any other chemicals or compounds (SOPUS, 2010).

Site use remained as an active oil storage facility until the 1950s, when the Site was kept on a standby reserve basis. In October of 1965, Shell Oil Company entered into a Purchase Option Agreement to sell the Site, with the oil storage reservoirs intact, to Richard Barclay or his nominee. Richard Barclay was a principal in Barclay Hollander Curci, later renamed Barclay Hollander Corporation (BHC), and Lomita Development Company (Lomita Development). Lomita Development was subsequently merged into BHC. BHC is now a wholly-owned subsidiary of Dole Food Company, Inc. (Dole).

In December 1965, Richard Barclay designated Lomita Development as his nominee for purchase of the Site. The property was evaluated for BHC and Lomita Development by Pacific Soils Engineering, a BHC-owned company, which performed soil borings and developed engineering

studies and grading plans for the Site. In 1966, BHC and its contractors conducted these studies, removed the remaining residual oil and water from the reservoirs, demolished the reservoirs and graded the Site. Lomita Development's request to rezone the Site from industrial to residential was approved by Los Angeles County in October 1966, and in the same month, title was transferred to Lomita Development under the Purchase Option Agreement. Construction of homes began in 1967 and was apparently completed by the early 1970s. The Site has remained residential since that time. More detailed information on the Site background is included in Appendix A (Geosyntec, 2010b) of the Plume Delineation Report (URS, 2010a).

2.2 REGULATORY INVOLVEMENT

The Site came under the attention of the Regional Board in 2008 when environmental investigations for the neighboring former Turco Products Facility, located directly west of the Site, discovered contamination by petroleum hydrocarbons at sample locations within the former Kast Property. The Department of Toxic Substances Control (DTSC) communicated these findings to the Regional Board in March 2008, and in April 2008 the Regional Board sent an inquiry to Shell regarding the status of any environmental investigations at the Site. This inquiry was followed by the Regional Board's CWC Section 13267 Order to Conduct an Environmental Investigation at the former Kast Property issued to Shell on May 8, 2008. Shell has conducted a series of investigations, pilot studies, and other environmental evaluations of the Site in response to that Order and subsequent 13267 Orders issued on October 1, 2008 and November 18, 2009, Section 13304 Order dated October 15, 2009, and CAO R4-2011-0046 dated March 11, 2011, as amended.

This Revised RAP is being submitted in response to the CAO and subsequent RWQCB comments and directives issued as modifications to the CAO, particularly the RWQCB's letter dated January 23, 2014 directing Shell to submit a RAP and HHRA, pursuant to CWC Section 13304, and the Regional Board's letter dated April 30, 2014 providing review comments and further directives on the RAP, HHRA and FS submitted on March 10, 2014.

2.3 SUMMARY OF SITE CONDITIONS AND STATEMENT OF THE ISSUE

As described below in Section 3, the Site has been impacted with petroleum hydrocarbons associated with crude oil storage during the period prior to residential redevelopment. The distribution of hydrocarbons was significantly affected by reservoir demolition and Site grading activities by the developer.

Crude oil is a complex mixture of various petroleum hydrocarbon compounds. Total petroleum hydrocarbon (TPH) impacts, reported in general hydrocarbon chain ranges corresponding to gasoline (TPHg), diesel (TPHd), and motor oil (TPHmo), occur in shallow and deep soils at the Site together with volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs). VOCs, including benzene, and methane resulting from

degradation of petroleum hydrocarbons are present in soil vapor[2] (also referred to as soil gas); dissolved-phase VOC and TPH impacts quantified as TPHg, TPHd, and TPHmo-range hydrocarbons are present in groundwater, and LNAPL consisting of crude oil is locally present in groundwater underlying a portion of the Site. In addition to hydrocarbon-related impacts, the Site is locally impacted by chlorinated solvents, such as tetrachloroethene (PCE) and trichloroethene (TCE), and from a class of chlorinated compounds associated with treatment of potable water supplied to the community referred to as trihalomethanes (THMs).

As summarized in Section 6 and discussed in detail in the Revised HHRA (Geosyntec, 2014c), some of these chemical constituents, referred to as COCs, are present at concentrations that may pose an incremental cancer risk greater than the *de minimis* risk level of one in a million or a human health Hazard Index (HI) greater than 1. Although it does not present a human health risk based on toxicity, methane can potentially pose an explosion hazard where present in an enclosed space at a concentration between 5 and 15% in air and there is a source of ignition. In addition, concentrations of some COCs exceed criteria for the potential leaching to groundwater pathway.

Medium-specific (i.e. soil, soil vapor, and groundwater) Remedial Action Objectives (RAOs) have been developed based on Site characterization investigations completed at the Site. Numerical SSCGs for the COCs, where applicable, have been developed to achieve the medium-specific RAOs. The SSCGs are presented in Tables 5-1 (Soil), 5-2 (Soil Vapor), and 5-3 (Groundwater) of this Revised RAP for soils from 0 to 10 feet and support unrestricted residential land use for the Site. These medium-specific RAOs and SSCGs were used in conducting the Revised FS (Geosyntec 2014d). The Revised FS includes an analysis of technological and economic feasibility and incremental cost/benefit analysis in accordance with SWRCB Resolution 92-49 and other Applicable or Relevant and Appropriate Requirements (ARARs). Based on the analysis in the Revised FS, the response actions described in this Revised RAP were developed.

2.4 SITE SETTING, GEOLOGY AND HYDROGEOLOGY

The Site is located within the West Coast Basin of the Los Angeles Coastal Plain, approximately 3 miles northwest of Long Beach Harbor. The Site is relatively flat, with a gradual slope to the northwest. The elevation across the Site ranges from approximately 30 to 40 feet above mean sea level (msl). The Site is not located within a 100- or a 500-year Federal Emergency Management Agency (FEMA) designated flood zone (URS, 2008). Historically, the Site area has been an oil production area, and active oil production wells are still present to the west and northwest of the Site. Due to historical oil production, the area directly south of the Site across Lomita Boulevard is designated as within the City of Los Angeles methane mitigation zone.

Geologically, the Basin consists of a very thick sequence of unconsolidated marine and continental sediments overlying consolidated sedimentary rocks that range in age from a few thousand years to tens of million years. Based on Site investigations, the upper 10 feet of soil beneath the Site is

[2] Unless otherwise specified in this document, the term "soil vapor" is used to address both sub-slab and deeper soil vapor.

dominantly fine grained and consists of silt with layers or lenses of silty fine sand. Soils between 10 and 15 feet bgs consist primarily of silt and silty fine sand. From 15 to 85 feet bgs Site soils consist of fine sands to silty fine sand. Soils encountered between 85 and approximately 180 feet bgs consist of silt, silty sand, and fine to medium sand.

The shallowest groundwater encountered beneath the Site occurs within the Bellflower aquitard, an overall fine-grained unit that locally has sandy intervals. First groundwater occurs at a depth of approximately 53 feet beneath the Site, with a groundwater flow direction to the northeast (URS, 2014a).

The Gage aquifer occurs beneath the Bellflower aquitard and extends from approximately 90 to 170 feet bgs. Groundwater flow direction in the Gage aquifer is to the east-northeast. The Lynwood aquifer, also known as the "400-foot Gravel," and the deeper Silverado aquifer are located below the Gage aquifer and may be merged in the Site vicinity (CDWR, 1961). The Lynwood aquifer is dominated by coarse sand and gravel in the Site vicinity (Equilon, 2001). These two aquifers extend from approximately 200 feet bgs to at least 550 feet bgs in the Site vicinity. The Lynwood and Silverado aquifers are major sources of groundwater for municipal drinking water wells in the Los Angeles Basin (Equilon, 2001). However, neither the Gage aquifer, nor the shallow Bellflower aquitard (in which the first regional unconfined groundwater was encountered at the Site) is a known source for drinking water in the Site area and future use is unlikely due: 1) high total dissolved solids and other water quality issues unrelated to Site conditions, (2) is present in a low yield, thin aquifer, (3) restrictions on groundwater pumping in the basin due to the adjudication of the groundwater resource; and, (4) the overlying land use is completely residential without the needed open space for water production infrastructure.

The nearest drinking water well, CWS Well 275, is located 435 feet west of the western Site boundary, upgradient of the Site and downgradient of the Former Fletcher Oil Refinery (Figure 2-2). CWS Well 275 produces water from the Lynwood and Silverado aquifers which are below 200 feet bgs in this area. Drinking water is supplied to the Carousel neighborhood and surrounding communities by California Water Services Company (Cal-Water), which regularly tests the drinking water to ensure that it meets state and federal drinking water standards. Information on the quality of water provided by Cal-Water is available from https://www.calwater.com/waterquality/water-quality-reports/rd/ Background Information on Surrounding Properties

Summarized below is information regarding surrounding impacted properties that have documented releases and are potential contributors to impacts at the Site. These former facilities are being investigated under the direction of either the DTSC or the RWQCB. Their locations are shown on Figure 2-2. Additional information regarding these sites is provided in the SCM (Geosyntec, 2010b), included as Appendix A to the Plume Delineation Report (URS, 2010a) and the Revised SSCG Report (Geosyntec, 2013c).

2.4.1 Former Turco Products/Purex Facility

The former Turco Products/Purex Facility (Turco) is located directly west of the northern half of the Site. From 1960 to 1989, Turco processed industrial and janitorial chemicals and conducted chemical milling operations at the facility. Activities associated with Turco's operations resulted in

contamination of soil and groundwater by VOCs. In addition, Turco had an underground gasoline storage tank. Remediation of the property is being conducted by the current property owner, Pedro First Ltd., under DTSC oversight.

Investigations at the former Turco Facility detected volatile compounds, including benzene, toluene and chlorinated VOCs (e.g. PCE and TCE), in the groundwater (DTSC letter to Regional Board, March 2008). According to data contained in the second semi-annual groundwater monitoring report (Leymaster, 2013), both diisopropyl ether (DIPE) and tert-butyl alcohol (TBA) have been detected in Turco wells in the past; however, the data indicate that oxygenated solvents are infrequently analyzed in groundwater samples. The groundwater flow direction on the Turco property is generally to the northeast, thus the Turco property is upgradient from the Site, and it is possible that some contaminants have migrated from the former Turco facility property onto the Former Kast Site.

2.4.2 Former Fletcher Oil and Refining Company

Fletcher Oil and Refining Company (FORCO) operated an oil refinery from approximately 1939 to 1992 on a property currently owned by the Los Angeles County Sanitation District about one-third mile west and upgradient of the Site. FORCO also owned an approximately nine-acre parcel of property known as the Fletcher Oil Storage Yard on the east side of Main Street from 1976 to 1989.

FORCO conducted refining and storage of petroleum products, including crude oil, light distillates (gasoline, naphtha), heavier distillates (diesel fuel, heavy fuel oils and asphalt), and jet fuel. During Fletcher's use of the land east of Main Street as a storage yard, a cluster of nine directional oil production wells, drilled from the same platform, was located on the western edge of the parcel. Aerial photographs indicate the presence of what appeared to be sumps or ponds, as well as several aboveground storage tanks (ASTs) on the property in the past.

The FORCO site is being investigated and remediated under RWQCB oversight under a CWC Section 13267 Order (Site Cleanup No. 0451A, Site ID No. 2040074). Soil and groundwater at the Fletcher Oil site are impacted by petroleum hydrocarbons with impacted groundwater extending offsite to the east of the FORCO property. Two draft cross sections recently prepared by Regional Board staff show contoured benzene concentrations in groundwater emanating from the former FORCO refinery extending beneath the former Turco property, and further extending beneath the former Kast Property (Figures 4 and 5 attached to draft letter to Sanitation District No. 8 from Greg Bishop, P.G., RWQCB project manager for the former Fletcher refinery site dated January 14, 2014; RWQCB, 2014a).

2.4.3 Oil Transport Company Inc.

From 1953 through approximately 1995, Oil Transport Company Inc. (OTC) occupied the property adjacent and to the southwest of the former Kast Property. The OTC site was originally two properties with different uses. The smaller area (approximately 0.93 acres) was developed with several structures, including a chicken processing plant. On the larger portion of the property (approximately 8.2 acres), OTC operated a trucking firm that specialized in the transportation of crude oil and asphalt and also conducted truck washing operations on the property. OTC's reported operations included seven single-walled USTs for fuel and waste oil in four areas on the property, an

oil well, several ASTs for crude oil storage and the associated conveyance piping. At least one clarifier is known to have existed on the property.

In about 1995 the property was acquired by Blue Jay Housing Partners for redevelopment as the Monterey Pines community of single-family homes. The USTs were removed, along with one of the clarifiers, in September 1995. Three of the seven USTs had corrosion holes and contamination was evident in the soils surrounding the tanks (PIC Environmental Services, 1995a). Impacted soils were subsequently excavated and stockpiled onsite and treated through vapor extraction or used onsite as base material for asphalt (PIC Environmental Services, 1995b). OTC was issued a closure letter in 1996 (RWQCB, 1996b).

More recently, the U.S. Environmental Protection Agency (USEPA) conducted an investigation of the Monterey Pines community in response to a request from DTSC. US EPA's report (Ecology & Environment, 2013) states that the former OTC facility included use of chlorinated solvents in a three-stage clarifier, which resulted in PCE-impacted soils at the Site. Ecology & Environment's field investigation documented the presence of PCE and its breakdown products in soil and soil vapor beneath the Monterey Pines and Carousel communities.

2.4.4 Oil Wells

A number of oil wells are shown in the Site vicinity on California Department of Conservation Division of Oil, Gas and Geothermal Resources maps (CDOGGR Map No. 128, 1998). The CDOGGR records did not identify wells on the former Kast Property. However, six wells were identified west of the Site between the western Site boundary and South Main Street, and three wells were identified east of the Site. One of the wells located west of the Site is located at the current location of the Monterey Pines Community directly west of the southern portion of the Site. That well has been abandoned, and a vent pipe for the well is visible near the intersection of Monterey Drive and Petaluma Lane. Two of the wells located east of the Site, referred to as Morton & Dolley Nos. 45 and 46, were located in close proximity to the current location of Island Avenue. Note that Los Angeles County Code requires evaluation of methane hazards for any new construction located within 300 feet and additions or alterations to existing buildings or structures located within 200 feet of active, abandoned or idle oil or gas well(s).

2.4.5 Dry Cleaners

City of Carson documents indicate that several dry cleaner/laundry facilities were present along E. Lomita Blvd at different times from 1971 and 1997 and along S. Main St between 1998 and 2002. Chemicals typically used at dry cleaner and laundry facilities are known to contain PCE.

Because of their proximity to the Site, it is possible that facility operations have impacted the Site through groundwater flow in a northeasterly direction from Lomita, and the area immediately north of the Site from the Main Street locations.

2.4.6 Pipelines

Based on a Los Angeles County Road Department pipeline map (LAC Sheet W-312, undated), there are 10 petroleum lines within the right-of-way in Lomita Avenue, directly south of the Site. Four of

these are shown as abandoned on the map. Most are located in the northern half of Lomita Avenue, adjacent to the Site. Three petroleum pipelines are shown in the railroad right-of-way directly north of the Site running parallel to the railroad tracks. Two are located north of the railroad lines and one is located south of the railroad line, adjacent to the Site (LAC Sheet W-301, undated).

3.0 PREVIOUS INVESTIGATIONS

URS and Geosyntec have conducted extensive multimedia sampling at the Site during multiple investigations from 2008 to present. All of Shell's work at the Site has been conducted with RWQCB approval and oversight following work plans reviewed and approved by the RWQCB. All of these work plans and reports documenting findings of the work conducted are available to the public on the SWRCB GeoTracker website at http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T10000000228.

Investigations at the Site included:

- Assessment in public rights-of-way, the adjacent railroad right-of-way, and other non-residential areas consisting of:
  - Shallow and deep soil sampling;
  - Shallow and deep soil vapor sampling;
  - Advancing CPT/ROST and CPT/UVOST soundings for LNAPL assessment;
  - Groundwater monitoring well installation and sampling;
  - Background outdoor air sampling; and
  - Background soil sampling;
- Assessment at individual residential properties consisting of:
  - Methane screening;
  - Sub-slab soil vapor probe installation and sampling;
  - Shallow soil sampling, and
  - Indoor and outdoor air sampling.
- Assessment of environmental impact and feasibility of removal of residual concrete reservoir slabs.
- Pilot testing to evaluate different potential remedies for Site impacts (discussed in Section 4).

3.1 ASSESSMENTS IN NON-RESIDENTIAL AREAS, PUBLIC STREETS, AND RAILROAD RIGHT-OF-WAY

Assessments in the public streets and railroad right-of-way were conducted in multiple events starting in 2008 and extending into 2014, although the bulk of this assessment work was conducted between 2009 and 2012. Boring and soil vapor probe locations are shown on Figure 3-1, and groundwater monitoring well locations are shown on Figure 3-2.

The initial assessment work was designed to investigate soil, soil vapor, and groundwater conditions onsite and was then expanded to include assessment work directly offsite. Additional soil vapor probes were also installed to better delineate some areas with higher impacts.

As of May 1, 2014, 614 soil samples were collected from 108 locations in public streets and in the railroad right-of-way at depths ranging from 1 to 80 feet bgs. In addition, 356 soil vapor samples

have been collected from 171 soil vapor probe locations in public streets and the railroad right-of-way. Soil vapor sample depths range from 1 to 60 feet bgs although most sample depths are in the upper 5 feet bgs. Soil vapor continues to be sampled quarterly from 5 feet bgs in 10 soil vapor probes. Additionally, as permitted by Site conditions, samples are collected at eight paired 1-foot probes and four paired 1.5-foot probes. These probes are paired with 5-foot probes for shallow, sub-slab equivalent assessment. In addition, URS conducted monthly methane monitoring of 69 utility vault locations onsite from January through June 2012, quarterly for the second half of 2012, twice in 2013, and in the first two quarters of 2014. The vaults are currently monitored on a quarterly basis.

Groundwater monitoring wells screened in the shallow zone (water table) aquifer were installed onsite in the initial assessment work. Additional water table wells were installed on and offsite and four onsite dual-completion (two wells in one borehole) Gage aquifer wells were installed to better define the lateral and vertical extent of hydrocarbon related impacts. Depth to first water (shallow zone aquifer) onsite ranges from approximately 51 to 65 feet bgs. As mentioned in Section 2.4, the Gage aquifer extends from approximately 90 to 170 feet bgs. Each of the four dual-completion Gage aquifer wells were installed so that one well is screened in the lower Gage and the other in the upper Gage aquifer (URS, 2011c).

There are currently 25 groundwater monitoring wells that have been installed and are monitored quarterly. Quarterly groundwater monitoring started in August 2009 after the first set of wells was installed. Groundwater flow direction in the water table aquifer is to the northeast and is east-northeast in the Gage aquifer.

Street assessment work and the results were documented in reports that were submitted to the RWQCB. The primary assessment reports for this work are:

- Final Phase I Site Characterization Report (URS, 2009c);
- IRAP Further Site Characterization Report (URS, 2010b);
- Plume Delineation Report (URS, 2010a);
- Supplemental Site Delineation Report (URS, 2011b); and
- Gage Aquifer Investigation Report (URS, 2011c).

Additionally, individual reports have been submitted for the periodic monitoring of soil vapor in the streets, for monitoring of utility vaults, and for groundwater monitoring.

3.2 ASSESSMENT AT INDIVIDUAL RESIDENTIAL PROPERTIES

Residential Site characterization activities, referred to as the Phase II Site Characterization, focus on assessing conditions at individual residential properties and include screening of indoor air for methane, sampling and analysis of soils to a depth of 10 feet bgs, and installation, sampling and analysis of exterior and interior sub-slab soil vapor probes. These investigations are being conducted in accordance with the RWQCB-approved *Work Plan for Phase II Site Characterization* (URS, 2009b). Indoor air sampling was subsequently added to the residential investigation program and is being conducted in accordance with the *Indoor Air Sampling and Analysis Work Plan* (Geosyntec,

2009a). URS has and continues to sample residential properties as access becomes available. Data for each sampling event at each property are documented and evaluated in an interim residential sampling report and submitted to the RWQCB within 45 days of the receipt of all data from the laboratory.

Through May 23, 2014, 95% of the residences have had some sampling and 79% have completed the required sampling including two rounds of indoor air sampling. Over 800 residential sampling reports have been submitted to the RWQCB. A copy of the residential sampling report is also sent to the homeowner or the homeowner's representative.

3.2.1 Methane Screening

Methane can occur from the natural breakdown of organic materials, including petroleum hydrocarbons. Methane is also the primary component of natural gas used for heating and cooking. URS conducted methane screening inside each house, as access was granted, using a hand held methane meter and a flame ionization detector (FID). Methane screening is conducted throughout each room of the house, inside closets and cabinets and other enclosed spaces where methane could potentially accumulate, at utility connections, wall sockets, drains and around toilets. Most houses have been screened multiple times. This method offers a real-time evaluation of whether methane concentrations in the explosive/combustible ranges are present in the home.

As of May 23, 2014, 270 of the 285 homes onsite have been screened for methane. Methane due to the presence of petroleum hydrocarbons in the subsurface was not detected in any of the homes screened. Fire and explosion hazards have not been identified at any residence due to methane concentrations from degradation of hydrocarbons in soil vapor.

Since 2009, URS has identified natural gas leaks at over 100 utility connections that range from small to significant. The fire department has been called six times to report leaking gas lines in homes where concentrations exceeded 2 to 10% of the lower explosive limit (LEL). None of these were related to soil or soil vapor conditions. The Gas Company was contacted over 50 times to check and repair leaks after URS recommended to the homeowner or the homeowner's representative that they call the Gas Company to have them check a leak.

3.2.2 Soil Sampling

Soil samples generally were collected from multiple locations at each property sampled at depths of 0.5, 2, 5 and 10 feet bgs, where feasible. Samples were also collected at other depths when field observations or field instrument readings indicated possible impacts. The number of locations at each property targeted a sampling density of one boring per approximately 200 square feet of area of exposed soil or vegetation in the front and back yards of residential properties in accordance with the *Addendum Work Plan for Phase II Site Characterization* dated April 19, 2010 (URS, 2010d). As of May 23, 2014, 10,360 soil samples have been collected at 270 of the 285 properties.

3.2.3 Sub-Slab Soil Vapor Sampling

Sub-slab soil vapor probes have been installed through concrete hardscape near the house in the front and back yard and through the floor slab of the home when access was granted. Sub-slab soil vapor

sampling is being done to assist in evaluating VOC and methane impacts and the potential for vapor migration to indoor air. Sub-slab vapor samples have been obtained from nearly every property tested, with many homes having three or four rounds of sample collection. As of May 23, 2014, 2,401 sub-slab soil vapor samples have been collected and analyzed from 271 of the 285 properties. Sub-slab soil vapor samples have been collected at most of these properties on at least three occasions.

3.2.4 Indoor Air Sampling

Shell agreed to sample indoor air at every residence onsite regardless of whether indoor air sampling was indicated by sub-slab soil vapor results. Prior to sampling, a chemical inventory of the residence is conducted at least two days before indoor air sampling begins. Household items with the potential to influence sampling results are removed from inside the house and either stored in the garage or in a storage pod outside the house. Indoor air samples are collected at two locations inside the house and one location in the garage, and outdoor air samples are collected in the front yard and back yard at the same time. The air samples are each collected over a 24-hour period.

Two rounds of indoor air sampling are recommended for each residence to evaluate potential temporal variation. As of May 23, 2014, indoor air sampling has been conducted at least once at 255 properties and has been conducted twice at 234 properties. Through May 23, 2014, 1,470 indoor air samples and 975 outdoor air samples have been collected from the 255 properties tested for indoor air.

3.2.5 Human Health Screening Risk Evaluation (HHSRE)

A Human Health Screening Risk Evaluation (HHSRE) was conducted after each sampling event at each property. The HHSRE is a preliminary conservative evaluation, not to be confused with the HHRA, which has been prepared as a part of the remedial planning for the Site and is summarized in Section 6 and concurrently submitted as a separate document (Geosyntec, 2014c). Both the HHSRE and the HHRA use very conservative, health-protective criteria for purposes of determining whether any further actions are warranted; an exceedance in either of these analyses does not necessarily mean that a health risk will occur. Each HHSRE evaluates available analytical results of the indoor air, soil, and sub-slab soil vapor samples collected at an individual property. The purpose of the HHSRE is to provide a preliminary evaluation of potential human health risks associated with detected constituents of potential concern (COPCs) at the property to identify if interim actions are warranted. The results for the HHSRE are summarized in residential sampling reports for individual properties. Copies of residential sampling reports are provided to the Regional Board and to the residents or to the residents' legal representative. Results of the HHSRE are presented in terms of a Risk Index (RI) for potential exposure to cancer-causing chemicals and a Hazard Index (HI) for exposure to non-cancer-causing chemicals based on chronic effects. A RI or HI value of greater than 1 has been used to identify if further action (e.g., additional investigation, data analysis, or interim measures) may be warranted at the property.

As presented in the *Data Evaluation and Decision* Matrix (Geosyntec, 2010a), as a precautionary measure in advance of the results of the full HHRA, if surface (0 to 2 feet bgs) or subsurface (2 to 10 feet bgs) soil concentrations of COPCs at a property exceeded screening levels such that the RI was

greater than 1 and less than 100 or cumulative HI or TPH HI was greater than 1 and less than 10, residents were advised to minimize contact with and disturbance of soils. If the RI was equal to or greater than 100 or the HI or TPH HI was greater than or equal to 10 for surface soils, residents were advised to avoid contact with surface soils and that interim institutional and/or engineering controls be implemented. For subsurface soils, since contact can only occur through bringing the subsurface soil to the surface, residents were advised to avoid disturbance of subsurface soil and that interim institutional and/or engineering controls be evaluated. If sub-slab soil vapor concentrations resulted in a RI or HI of 1 or greater, collection of indoor air samples was recommended to evaluate the potential for vapor intrusion. (As noted above, Shell agreed to perform indoor air sampling at each residence regardless of whether it was indicated by soil vapor sampling results.)

An evaluation was conducted using multiple lines of evidence to assess whether constituents detected in indoor air were a result of background sources or subsurface vapor intrusion. Detected indoor air concentrations were compared to: (1) outdoor air and garage air concentrations, (2) individual constituents detected in sub-slab soil vapor; and, (3) the typical range of concentrations found in homes due to common household sources. As of May 23, 2014, Geosyntec and URS have concluded that constituents detected in indoor air are reflective of background sources. In their review of Follow-up Indoor Air Reports and Final Interim Reports, the Regional Board and OEHHA generally have agreed with these findings.

3.3 FINDINGS OF ASSESSMENT WORK

Sampling completed during Site characterization confirms that there were petroleum releases at the Site. In addition, there appears to be evidence of offsite sources for chlorinated compounds detected in all Site media and for certain groundwater impacts (e.g., fuel oxygenates and chlorinated VOCs). Petroleum hydrocarbon and related VOC and SVOC impacts occur in shallow and deep soils; VOCs and methane resulting from degradation of petroleum hydrocarbons are present in subsurface soil vapor; dissolved-phase VOC and TPH impacts are present in groundwater, and LNAPL is locally present above groundwater.

In addition to hydrocarbon-related impacts, impacts are also locally present from chlorinated solvents, such as PCE and TCE, and from THMs. Although the chlorinated solvents TCE and PCE are found sporadically around the Site in shallow soils, their presence in groundwater is related to offsite sources. THMs are commonly found in drinking water that has been treated with chlorine or chloramines and form when chlorine reacts with organic matter in the water (California Water Service Company; https://www.calwater.com/help/water-quality/). THMs have all been detected in Site soils, soil vapor, and groundwater. Because their source is related to drinking water delivered to the Site by Cal-Water, THMs are not considered Site-related COCs.

Although petroleum hydrocarbons in the subsurface have likely fermented to produce methane at depth, such methane is generally not present in the shallow subsurface and has not been detected in residences or enclosed areas of the Site at levels that pose a hazard. Methane generated at depth typically migrates very slowly through soils because it is not under significant pressure. Transport is primarily through diffusion, and methane moving upward from depth is typically biologically degraded and/or significantly attenuated in the aerobic shallow soils before it reaches the surface.

This bio-attenuation in the vadose zone is evident in the soil vapor data collected at the Site that has been reported in the Interim Residential Reports and the Street Soil Vapor Monitoring Reports. These natural mechanisms explain the lack of elevated methane levels in the sub-slab soil vapor samples and in indoor air within the residences that have been tested.

As summarized in Section 6 and discussed in detail in the Revised HHRA (Geosyntec 2014c), some COCs detected at the Site are present at concentrations that result in estimates of incremental lifetime cancer risk (ILCR) and noncancer hazard that are above regulatory thresholds or may pose a concern for the potential leaching to groundwater pathway. Although exposure to methane does not, by itself, pose a risk to human health, if methane accumulates in an enclosed space at a concentration between approximately 5% or 50,000 parts per million by volume (ppmv, termed the lower explosive limit, LEL) and 15% or 150,000 ppmv (termed the upper explosive limit, UEL) in the presence of sufficient oxygen and a source of ignition is present, methane may pose a combustion or explosion hazard. Methane in soil vapor at depth does not pose a combustion or explosion hazard regardless of concentration or oxygen content due to the small dimension of pore spaces that effectively acts as a flame arrestor (Sepich, 2013).

The discussion below is intended to highlight predominant risk driving compounds and is not intended to be exhaustive. More detailed discussions are included in the individual site assessment and monitoring reports for the different sets of data.

3.3.1 Impacts in Soil

Elevated TPH and other VOCs and SVOCs related to petroleum releases were found in Site soils: (1) beneath the footprint of the former reservoirs; (2) within the fill material above the base level of the former reservoirs (the source of these impacts appears to be from the developer's reuse of petroleum-impacted fill from other portions of the Site, such as berm areas), and (3) in areas outside the footprints of the former reservoirs. The impacts outside the former reservoirs are potentially from a combination of sources, including possible former onsite or offsite pipelines or spills during operation of the storage facility, the developer's grading activities, offsite sources, and shallow soil sources associated with residential activities. The specific analytes TPHg, TPHd, TPHmo, benzene, naphthalene, and other PAHs (shown as benzo(a)pyrene (BAP)-equivalents[3]), are representative of Site COCs with elevated concentrations in soil. The overall distribution of these analytes at 2, 5 and 10 feet bgs is shown on Figures 3-3 through 3-8. As can be seen on these figures, detections at 2 feet are much less frequent and lower in concentration than detections at 5 and 10 feet bgs. Additionally, to assist in remedial action planning, updated contour plots of this group of analytes in soil have been created and are provided on Figures 3-9 through 3-14[4]. These contour plots have been provided in

[3] Benzo(a)pyrene equivalents are concentrations estimated by summing the detected carcinogenic PAH concentration multiplied by a toxicity equivalency factor that relates the toxicity of individual carcinogenic PAHs to that of benzo(a)pyrene. See HHRA Report (Geosyntec, 2014a) for additional details.

[4] The concentration contours were prepared using Mining Visualization System (MVS) Premier software (version 9.52, C Tech Development Corporation). MVS is an analysis and visualization software package, commonly used by environmental practitioners to assist in the interpolation and visualization of spatial information.

response to a directive from the RWQCB in their January 23, 2014 letter to consider the contour plots in defining soil remediation boundaries. The contour maps shown in Figures 3-9 through 3-14 are updates of contour maps previously submitted to the Regional Board on April 29, 2011 in response to the Regional Board's February 18, 2011 comments approving a step-out sampling work plan that was prepared subsequent to the Site Delineation Report, and updates of the contour maps provided in Appendix B of the March 10, 2014 RAP. Due to the interpolation inherent in the software used to extrapolate between data points to generate the contours, these maps are not necessarily representative of the actual distribution of impacts. Also, it should be noted that these maps interpolate data from known sample points to areas where no sampling has been conducted and therefore show the presence of impacts based on extrapolation where there are not data to confirm whether impacts actually exist.

Higher concentrations of petroleum hydrocarbons tend to be located inside and closer to the edges of the former reservoir footprints. The distribution of TPHd at 2 feet bgs correlates with the reservoir footprints but TPHd is also detected outside the reservoir footprints, particularly in the southern and eastern portion of the Site (Figures 3-4 and 3-10). At 5 and 10 feet bgs, TPHd detections are more common with higher concentrations inside the footprints of the former reservoirs. There are also detections outside the reservoir boundaries, including the area where the former sump was located in the eastern part of the Site.

Concrete slabs, interpreted to be reservoir bottoms, were encountered in some of the borings at depths ranging from approximately 8 to 10 feet bgs. Soil just above the concrete was generally moist to wet but there was no evidence of significant ponding on top of the slabs. Where cored for deeper borings, the concrete was in good condition with staining on the top and, on some cores, bottom surfaces. The interpreted distribution of residual concrete reservoir slabs based on historical information and data collected during Site investigations is shown on Figure 3-21.

3.3.2 Impacts in Soil Vapor

A number of constituents have been detected in soil vapor at the Site. Methane, benzene, and naphthalene are representative of Site-related COCs detected in soil vapor. The chlorinated solvents PCE and TCE and THMs have also been detected locally in soil vapor.

Methane has been detected in subsurface soil vapor samples, particularly deeper soil vapor samples, collected at the Site. Methane screening conducted in indoor structures at the Site and utility vaults, storm drains, and sewer manholes at and surrounding the Site has not identified methane concentrations in enclosed spaces that indicate a potential safety risk.

Very few instances of methane detection above 1% (i.e., 20% of the LEL) have been found in sub-slab soil vapor, and in all but one location, the results of methane speciation indicate the source was either a natural gas pipeline leak or sewer leak. Methane resulting from biodegradation of residual

petroleum hydrocarbons has been identified in one sub-slab garage probe at one property[5]; however, methane was either not detected or at very low (less than 0.01%) in the two other sub-slab soil vapor probes at this property. Furthermore, no methane exceedances were found at this property during the indoor air screening, and methane has not been detected in indoor air samples analyzed by the laboratory. Engineering controls have been installed to mitigate potential risks due to methane detected at this location.

Through May 23, 2014, methane concentrations slightly above the interim action levels of 0.1% and 0.5% were detected in one sub-slab probe during one sampling event at five different properties. At four of these properties, methane concentrations were above the lower methane SSCG of 0.1% but were not above the upper methane SSCG of 0.5%. In all four cases, the methane detections were not reproducible in subsequent sampling events. At one location, a methane concentration of 0.58%, slightly above the upper methane SSCG, was detected in a single sampling event. Because it was a replacement probe, that sub-slab probe has only been sampled once. This location is considered for sub-slab mitigation as part of the recommended Site remedy discussed in Section 8. Methane concentrations detected in sub-slab soil vapor and in soil vapor at depths of 5 and 15 feet bgs are shown on Figure 3-15.

Benzene concentrations in sub-slab soil vapor and in soil vapor at depths of 5 and 15 feet bgs are shown on Figure 3-16. Benzene detections in sub-slab soil vapor are scattered and generally much lower than soil vapor detections at 5 feet bgs and deeper. As with methane, transport is primarily through diffusion, and benzene moving upward from depth is typically biologically degraded and/or significantly attenuated in the aerobic shallow soils before it reaches the surface. Elevated benzene concentrations at 5 and 15 feet bgs are present inside the footprint of the former reservoirs as well as outside.

Naphthalene concentrations in sub-slab soil vapor and in soil vapor at depths of 5 and 15 feet bgs are shown on Figure 3-17. Elevated naphthalene concentrations in sub-slab soil vapor samples are few and scattered. Elevated naphthalene concentrations at 5 feet bgs appear to be concentrated along 244th Street and scattered along Marbella Avenue. Naphthalene was not detected in soil vapor samples from 15 feet bgs.

3.3.3 Impacts in Indoor and Outdoor Air

As discussed above, constituents detected in indoor air were evaluated based on multiple lines of evidence. They were compared to outdoor air and garage air concentrations, to individual COCs detected in sub-slab soil vapor during the sampling event or during previous sub-slab soil vapor sampling events, and to the typical range of concentrations found in homes due to common household sources. As of May 23, 2014, based upon a multiple lines of evidence evaluation, Geosyntec and URS have concluded that constituents detected in indoor air are reflective of

[5] Sub-slab soil vapor methane concentrations exceeding interim action levels have been identified as a result of leaking natural gas utility lines, which were found at several of the residential properties, and a leaking sewer line at two residential properties.

background sources. In their review of Follow-up Indoor Air Reports and Final Interim Reports, the Regional Board and OEHHA generally have agreed with these findings.

An outdoor air background study was conducted that included upwind, downwind, and onsite sampling during four separate 24-hour events between July 31 and September 17, 2010 (Geosyntec and URS, 2010a; Geosyntec, 2013d). The outdoor air samples were collected at four locations west of the Site boundary, four locations east of the Site boundary, and four locations within the interior of the Site for each of the four separate events. The data collected were used to assess whether outdoor air contaminant concentrations within the Site boundary are statistically similar to upwind and downwind locations. Based on the statistical evaluation, all tests show that there is no evidence that the Site or downwind concentrations are different from the upwind concentrations. In their letter dated January 23, 2014, the Regional Board concurred with OEHHA's comments on this report, which included a statement that the outdoor air concentrations are similar to concentrations measured in regional studied conducted in the area and do not indicate that the Site or downwind concentrations are significantly different from upwind concentrations.

3.3.4 Impacts in Groundwater

Groundwater monitoring wells have been sampled quarterly since installation. Groundwater results from the most recent sampling event in the Second Quarter 2014 are included in Appendix B. Most of the groundwater monitoring wells are screened in the water table aquifer, the top of which ranges from approximately 51 to 65 feet bgs onsite. The remaining wells are screened in the Upper and Lower Gage aquifer onsite. The Gage aquifer extends from approximately 90 to 170 feet bgs. Groundwater results from the Second Quarter 2014 are generally consistent with previously reported results. Groundwater is impacted with Site COCs as well as with those attributed to upgradient sources; COCs attributed to offsite sources are discussed in detail in the Revised SSCG Report (Geosyntec, 2013c). These non-Site related COCs include tert-butyl alcohol (TBA) and chlorinated compounds (including TCE and PCE). Again, detailed rationale for these COCs originating from offsite sources is presented in Geosyntec (2013c).

Site-related COCs in groundwater exceeding California drinking water standards (Maximum Contaminant Levels [MCLs] or Department of Human Health Notification Levels [NLs]) are benzene, naphthalene, and arsenic. TPH also exceeds the Regional Water Quality Control Board, San Francisco Region (SFRWQCB) December 2013 Environmental Screening Levels (ESLs). These compounds and LNAPL are discussed below.

It should be noted that the drinking water supplied to the Carousel community by the water provider is screened in a lower aquifer than the impacted groundwater at the Site and is tested according to state standards and is safe to drink (California Water Service Company, 2013). No current or future use of the shallow zone and Gage aquifer at or near the Site is anticipated due to: (1) high total dissolved solids and other water quality issues unrelated to Site conditions, (2) is present in a low yield, thin aquifer, (3) there are restrictions on groundwater pumping in the basin due to the adjudication of the groundwater resource; and, (4) the overlying land use is completely residential without the needed open space for water production infrastructure.

3.3.4.1 LNAPL

If petroleum hydrocarbons from crude are present at sufficiently high concentration they may occur as a non-aqueous phase liquid (NAPL), which typically has lower density than water and is often referred to as "light NAPL" or LNAPL. The Interstate Technology & Regulatory Council (ITRC) defines mobile LNAPL as LNAPL that exists in the soil matrix in amounts that exceed residual saturation and thus can accumulate in monitoring wells (ITRC, 2009). Mobile LNAPL is not necessarily migrating. Further reference to LNAPL in this document refers to mobile LNAPL.

LNAPL has been detected at a measurable thickness in groundwater at the Site in two wells, MW-3 and MW-12, located approximately 43 feet from each other in Marbella Avenue. An LNAPL sample collected from Site monitoring well MW-3 and analyzed was characterized as a relatively unweathered crude oil. URS currently removes LNAPL from these wells monthly using dedicated pumps installed in the wells. To date, approximately 120 gallons of LNAPL have been recovered from MW-3 and MW-12. LNAPL has not been detected in any of the other groundwater monitoring wells at the Site.

3.3.4.2 Benzene

The distribution of benzene in Site groundwater is depicted on Figures 3-18, 3-19 and 3-20; these figures are based on data from the Second Quarter 2014 groundwater sampling event. The Second Quarter 2014 Groundwater Monitoring Report will be submitted by July 15, 2014.

As shown on Figure 3-18, benzene is present beneath much of the Site in the shallow groundwater zone. Benzene in Site groundwater is attributed to one or more of the following: leaching of benzene from hydrocarbon-impacted Site soils; leaching of benzene from LNAPL locally present at or near the water table beneath the Site; and/or migration onto the Site from upgradient sources, including the former Turco Products Facility and former FORCO refinery property (RWQCB, 2014a).

The highest concentrations of benzene detected in the shallow zone during the Second Quarter 2014 were in wells MW-13 and MW-6 (510 µg/L and 150 µg/L, respectively). Both monitoring wells are located in the northeastern portion of the Site. Offsite to the northeast (downgradient), benzene was detected in one downgradient well, MW-10, at a concentration of 9.7 µg/L.

Concentrations of benzene attenuate markedly in the underlying Gage aquifer as shown on Figures 3-19 and 3-20. The benzene concentration in MW-G04S, located directly downgradient of the former Turco Facility, is anomalously high in the Upper Gage and likely is due to impacts related to former operations at the Turco or FORCO sites as indicated by the presence of TBA, which is a fuel oxygenate historically added to refined gasoline. TBA may also occur as a breakdown product of methyl tert-butyl ether, which is also a gasoline additive, and is not a component of crude oil. As discussed in Section 2.5.2, two draft cross sections recently prepared by Regional Board staff show benzene concentrations in groundwater emanating from the former FORCO refinery and extending beneath the former Kast Property (RWQCB, 2014a).

Benzene was not detected in samples collected in the deeper portion of the Gage aquifer during recent monitoring events (Figure 3-20). As shown on Figures 3-18 through 3-20, the lateral and

vertical distributions of benzene at the Site are well defined. The Gage aquifer wells define the vertical benzene distribution, with the exception of the anomalously high benzene detection in shallow Gage well MW-G04S which, as discussed above, is attributed to an offsite source, and benzene was not detected in the lower Gage aquifer well at this location.

As discussed in the Revised SSCG Report (Geosyntec, 2013c), Geosyntec used public domain Monitoring and Remediation Optimization System (MAROS) software to model and evaluate the stability of the benzene groundwater plume at the Site. The MAROS analysis indicated it is likely that the benzene in Site groundwater is being attenuated through natural biodegradation processes and is a stable or decreasing plume. Model simulations predict a reduction of benzene concentrations to MCLs in 70 to several hundred years depending on the level of source removal. This conclusion is supported by the current observed distribution of benzene in the plume, which shows significant attenuation (to non-detect or near non-detect concentrations) at the downgradient plume edge near the property boundary. The conclusion is also supported by the significant age of the plume source (~50 years or more).

3.3.4.3 Naphthalene

Naphthalene has been detected in groundwater from the majority of Site wells. However, during the Second Quarter 2014 only well MW-13, located in the northern portion of the Site, had detected concentration that exceed the NL of 17 µg/L. Naphthalene historically was detected at a maximum concentration of 82 µg/L in MW-13 and has been detected in MW-14 at an historical high concentration of 35 µg/L (detected at 4.0J µg/L below the NL during the Second Quarter 2014). Concentrations of naphthalene historically exceeding the NL are limited to these two areas. MW-13 is the monitoring well with the highest detected concentration of benzene and other hydrocarbon-related VOCs at the Site.

3.3.4.4 Total Petroleum Hydrocarbons (TPH)

MCLs and NLs have not been established for TPH in groundwater. The SFRWQCB has established ESLs for TPHg, TPHd, and TPHmo in groundwater of 100 µg/L (latest update December 2013). TPH has been detected in Site monitoring wells at concentrations exceeding SFRWQCB groundwater ESLs. Based on Second Quarter 2014 data, the TPHg ESL was exceeded in eight wells, the TPHd ESL was exceeded in eight wells, and TPHmo ESL was exceeded in six wells (two of these TPHmo detections were at J-flagged estimated concentrations below the reporting limit). Monitoring well MW-13, located in 244th Street near Ravenna Avenue, consistently has had the highest TPH and VOC concentrations.

3.3.4.5 Arsenic

Arsenic has been detected in most of the Site monitoring wells. During the most recent groundwater monitoring event in which arsenic was sampled (Second Quarter 2014), arsenic concentrations exceeding the MCL of 10 µg/L were detected in four wells. Overall, arsenic concentrations have been declining in most wells with historic arsenic concentrations above MCLs. Arsenic was not detected above the MCL in the three offsite shallow zone downgradient wells. Dissolved arsenic

concentrations in the deeper Gage wells are significantly lower and the concentration in only one well, MW-G04S at a concentration of 19.6 µg/L, was above the MCL.

Although arsenic is identified as a Site COC, it is likely that a portion, if not all, of the arsenic present in groundwater is derived from native Site soils. Arsenic is a natural trace element that occurs in soils. Because arsenic is naturally soluble, dissolved arsenic is a common contaminant in southern California groundwater. Out of all wells sampled by the Water Replenishment District of Southern California (WRD) in the West and Central Groundwater Basins in the Los Angeles area, arsenic exceeds its MCL more than any other constituent (WRD, 2008). WRD (2008) reports that arsenic concentrations as high as 205 µg/L were detected in the wells they monitor.

In summary, it is known that arsenic is a regional contaminant in southern California. It is likely that at least a portion, if not all, of the dissolved arsenic beneath the Site is derived from natural sediments beneath the Site. Petroleum hydrocarbon impacts at the Site may enhance the solubility of arsenic by lowering oxygen levels in the subsurface, thus increasing the mobility of arsenic in soils beneath the Site. Once petroleum hydrocarbons are depleted, elevated arsenic would be expected to return to background concentrations. Based on groundwater monitoring well data, relatively elevated arsenic concentrations are localized in the central western portion of the Site and are attenuated significantly in the downgradient direction.

3.4 RESIDUAL CONCRETE RESERVOIR SLAB ASSESSMENT

Per requirements in the CAO, URS and Geosyntec prepared an assessment of the environmental impact and the feasibility of removal of residual concrete reservoir slabs (URS, 2013e). This assessment summarized historical information regarding activities of the developer during demolition of the residual concrete slabs and reservoir sidewalls, and findings from investigations that provide information on the location, depth and condition of the slabs. A map showing the interpreted lateral extent of the former reservoir slabs is provided as Figure 3-21.

The concrete reservoir slab assessment concluded that there is nothing unique about the former reservoir slabs that would indicate a specific need for their removal. During one of the excavation pilot tests, portions of the concrete reservoir slab beneath the front yard of a property were excavated, broken up and removed. The report concluded that removal of slabs beneath paved areas or homes would require the demolition of City streets and homes, which would have significant social, economic and environmental impacts on the residents of the Carousel tract and the local community. It was URS and Geosyntec's conclusion that the concrete reservoir slabs do not require removal from an environmental or human health perspective and the impacts associated with their removal far outweigh the benefits of removal.

The Regional Board commented on the reservoir slab assessment report in its letter dated January 8, 2014. The Regional Board clarified its position and revised its comments on the reservoir slab assessment in its letter of February 10, 2014. The reservoir slabs are addressed in this RAP based on the Regional Board's clarification letter.

4.0 SUMMARY OF INTERIM ACTIONS COMPLETED AND PILOT TESTING

Based upon findings of HHSREs conducted as part of Phase II Site Investigations of residential properties, evaluations of interim actions were conducted if RI or HI estimates exceeded criteria identified in the Decision Matrix (Geosyntec, 2010a). These evaluations are described in Section 4.1 below.

Multiple bench-scale and field pilot tests were completed to evaluate the effectiveness of using a number of technologies to treat COCs and methane in Site soils and soil vapor. These pilot tests were performed in accordance with the RWQCB-approved work plans *Addendum to the IRAP Further Site Characterization Report and SVE Pilot Test Work Plan* dated April 30, 2010 (URS, 2010d), *Pilot Test Work Plan for Remedial Excavation and In-situ Treatment Pilot Testing, Former Kast Property, Carson, California* dated May 10, 2011 (Work Plan, URS and Geosyntec, 2011) and *Phase II ISCO Bench-scale Test Work Plan* dated March 15, 2013 (Phase II Work Plan, Geosyntec, 2013a).

4.1 EVALUATIONS OF NEED FOR INTERIM ACTIONS

HHSREs were conducted for each property using very conservative and health-protective criteria as part of the Phase II Site Investigation process. Based on HHSRE findings presented in residential sampling reports, as a precautionary measure in advance of the preparation of the full HHRA, if shallow soil (0 to 2 feet bgs) concentrations of COCs exceeded screening levels such that the RI was greater than 1 and less than 100 or cumulative HI or TPH HI was greater than 1 and less than 10, residents were advised to minimize contact with and disturbance of soils. If the RI was equal to or greater than 100 or the HI or TPH HI was greater than or equal to 10, residents were advised to avoid contact with surface soils and that interim institutional and/or engineering controls be implemented. An exceedance of a criterion does not mean that there is a health concern, but that conservative interim measures may be warranted. For subsurface soils, since contact can only occur through bringing the subsurface soil to the surface, residents were advised to avoid disturbance of subsurface soil and that interim institutional and/or engineering controls be evaluated. If sub-slab soil vapor concentrations resulted in a RI or HI that exceeded 100, an evaluation of the need for interim engineering controls was conducted and collection of indoor air samples within 30 days was recommended to evaluate the potential for vapor intrusion. Based upon these recommendations and Regional Board review comments on individual Phase II Interim Reports, interim response actions for COCs exceeding screening levels in soils were further evaluated at 21 properties and reported in the Evaluation of Interim Institutional and/or Engineering Control Letters submitted to the Regional Board. For two residences, additional interim controls were recommended and implemented.

4.1.1 Summary of Interim Actions Completed

At 378 E. 249th Street, where elevated methane related to petroleum hydrocarbon degradation was detected in soil vapor under the attached garage, interim actions including institutional and/or engineering controls were evaluated. Because the methane in the sub-slab vapor probes was of limited extent, not under pressure, and methane was not detected during screening of the ambient air

in either the home or garage, or in indoor air samples collected from both the garage and home and analyzed by an independent laboratory, the methane observed in the garage sub-slab soil vapor probe does not pose a safety concern. As a precautionary measure, SOPUS proposed to implement a methane mitigation system at this property. The methane mitigation system was installed in December 2012 in accordance with a work plan and engineering design approved by the RWQCB and L.A. County Department of Public Works Environmental Programs Division. Monitoring of the system has been performed upon installation, monthly for the first three months, and quarterly for the remainder of the first year. Testing has shown no methane hazard at that residence.

At 24533 Ravenna Avenue, due to the isolated location and depths of samples with detected concentrations of COCs exceeding screening levels, engineering controls consisting of providing a barrier through alternative landscaping was proposed for this residence. Subsequently surgical excavation of the elevated risk area was recommended as part of the excavation pilot test program, which is discussed below in Section 4.3.3. Following completion of the excavation pilot test, a follow up HHSRE of the remaining soils data indicated no significant risks to human health at this property.

4.2 SUPPORT TO UTILITY EXCAVATIONS AND HOMEOWNERS' ACTIVITIES

As part of interim institutional controls, on behalf of SOPUS URS is a member of Underground Service Alert (USA) and receives dig alerts for the Site when USA is notified by parties conducting subsurface work at the Site. URS calls the contact person to discuss the upcoming work and to notify him or her that impacted soil at the Site may be encountered. URS provides field monitoring during the work, if requested, and arranges for soil disposal as needed. URS has provided field monitoring when AT&T has conducted underground line repairs within the Carousel Community. Additionally, field support has been provided to individual homeowners and their contractors when they have notified Shell of planned activities on their properties, such as plumbing repairs, driveway replacement, and landscaping improvements. Field support activities include monitoring for organic vapors, collection and analysis of soil samples when potential impacts are identified in excavations, and coordination with appropriate contractors for proper disposal of the excavated soils. These activities will continue as discussed in the Surface Containment and Soil Management Plan (Appendix C).

4.3 SUMMARY OF PILOT TESTING

Pilot tests have been completed in accordance with RWQCB-approved work plans to evaluate potential remedial actions for the Site. Several remedial technologies have been pilot tested to evaluate the effectiveness of each technology in addressing Site-related compounds, including:

- Soil vapor extraction (SVE) pilot testing at three locations;
- Bioventing pilot testing at six locations;
- Excavation pilot testing at two locations; and
- In-situ chemical oxidation (ISCO) bench testing using persulfate and ozone in two phases.

Detailed pilot testing procedures and results were provided in individual pilot test reports prepared by URS and Geosyntec and are summarized in the *Final Pilot Test Summary Report – Part 1* dated May 30, 2013 (URS and Geosyntec, 2013) and *Final Pilot Test Summary Report – Part 2* dated August 30, 2013 (URS, 2013d).

4.3.1 SVE Pilot Testing

SVE pilot tests were conducted to evaluate the potential effectiveness of using SVE to remove vapor-phase VOCs from subsurface soils in accordance with the RWQCB-approved Work Plan (URS, 2010d). Details of the SVE pilot test activities and results are in the S*oil Vapor Extraction Pilot Test Report* (URS, 2010f).

Three areas were selected for SVE pilot testing at shallow (5 to 10 feet bgs), intermediate (15 to 25 feet bgs), and deep (30 to 40 feet bgs) depth intervals. The effective radius of vacuum influence (ROVI) in the shallow zone (5 to 10 feet bgs) ranged from 24 to 78 feet with an average of approximately 50 feet. The effective ROVI in the intermediate zone (15 to 25 feet bgs) was estimated to be 112 to 131 feet with an average of approximately 125 feet, and the estimated ROVI in the deep zone (30 to 40 feet bgs) was 75 to 156 feet with an average of approximately 115 feet.

Based on the tests, SVE is a viable remedial technology for remediation of methane, VOCs, and the lighter-range petroleum hydrocarbons, such as gasoline-range hydrocarbons. This technology may also be effective on the lighter-range diesel fraction, but would not be effective by itself for longer-chain diesel-range hydrocarbons and motor oil-range petroleum hydrocarbons and SVOCs. However, increased airflow induced by SVE operation would induce oxygen to the subsurface that would promote microbial degradation of longer-chain hydrocarbons and, over the long term, reduce concentrations of these non-volatile compounds.

4.3.2 Bioventing Pilot Testing

Bioventing pilot tests were conducted to evaluate the potential effectiveness of bioventing to reduce concentrations of petroleum hydrocarbon constituents at the Site. Bioventing is an in-situ technology generally applicable to the remediation of a wide range of petroleum hydrocarbons. The aim of bioventing is to supply oxygen to the subsurface to enhance microbial degradation of hydrocarbons in the subsurface. The bioventing pilot testing was conducted in accordance with the *Pilot Test Work Plan* (URS and Geosyntec, 2011).

Bioventing pilot tests were conducted at six locations, four with vertical bioventing wells and two with horizontal bioventing wells installed in trenches. Results from the bioventing pilot tests are summarized in the final *Bioventing Pilot Test Summary Report* (Geosyntec, 2012b). Evidence of degradation of petroleum hydrocarbons was observed during the pilot tests, indicating that bioventing is a potential technology to remediate residual petroleum hydrocarbons

4.3.3 Excavation Pilot Testing

Excavation pilot testing was conducted to evaluate the feasibility of excavating impacted soils to a depth of 10 feet bgs and removing the concrete reservoir bases (slabs) located at approximately 8 to 10 feet bgs beneath portions of the former oil storage reservoirs, and also to evaluate smaller

"surgical" excavations. The excavation pilot tests were conducted in accordance with the *Pilot Test Work Plan* (URS and Geosyntec, 2011).

A slot-trench excavation was completed to approximately 10 feet bgs, including removal of the concrete reservoir slab, in the front yard of a property, and a surgical excavation was done to approximately 6 feet bgs in the back yard of a property to evaluate the ability to conduct surgical excavations for localized mass removal. The scope of excavations at these two locations was expanded to include excavation of the remaining portions of the front and back yards to a depth of 2 feet throughout the entire non-hardscape covered portions of the yards. Landscape restoration to the satisfaction of the homeowners was completed following completion of the pilot tests. Details are provided in the individual excavation pilot test reports (URS, 2013a and 2013b).

Overall excavation pilot test findings include the following:

- Soil excavation using slot-trenching and surgical excavation methods are technically feasible, subject to sufficient working space and observance of setback distances established based on location-specific geotechnical conditions.
- Excavation of yard areas to 2 feet bgs is readily implementable using a combination of mechanized equipment and hand tools.
- Noise impacts to the community can be managed to below maximum allowable levels per the City noise ordinance for the majority of excavation activities when conditions allow use of sound attenuation panels. Noise levels may be exceeded when it is not feasible to use sound attenuation panels. Although exceeding the percentile noise levels[6] during most of the excavation activities, both with and without the attenuation panels, maximum noise levels from the excavation pilot test operations are well within the range of noise levels common to urban environments including ambient noise levels recorded at these locations prior to the start of the excavation, and are unlikely to interrupt typical activities in nearby residences.
- Effective odor and vapor control can be achieved during excavation activities by using long-acting vapor suppressant foam when odorous soils are encountered.
- It is technologically feasible to remove most of the exposed concrete reservoir base within areas excavated using the slot-trenching method; however, some concrete around the margins of the trenches cannot effectively be removed due to logistical constraints. The concrete base was removed over approximately 75 to 80% of the excavated area (front yard), which represents approximately 5.3% of the total area of the lot at this property.
- Although the concrete reservoir floor had some surficial staining, standing fluids (hydrocarbons or water) were not encountered above the reservoir base. Where encountered in the slot-trench excavation, the concrete reservoir slab was intact and in good condition

[6] The percentile noise level (L_n) denotes the sound level that is exceeded for "n" percentage of time during the measurement period. The L_{10}, or the sound level exceeded 10% of the time, is typically used as a measure of event noise because it represents the loudest noise sources. The L_{50} is the median sound level, and L_{90} represents the ambient or background sound level.

without indications of weathering or degradation, and evidence was not observed in this excavation that the concrete slab beneath this property had been ripped or broken by the grading contractor during Site development. It does not appear that the concrete reservoir base is a continuing source of impacts at the slot-trench excavation location.

4.3.4 In-Situ Chemical Oxidation (ISCO) Pilot Testing

The use of ISCO at this Site would involve injecting chemical oxidants into the shallow soils to oxidize organic compounds. A preliminary feasibility evaluation for ISCO was conducted at the time the *Pilot Test Work Plan* was prepared (URS and Geosyntec, 2011). The preliminary feasibility evaluation concluded that sodium persulfate and ozone had greater potential for treatment of COCs than other oxidants considered. Based on this evaluation, ISCO bench-scale testing was conducted in two phases. The first phase is documented in the Technical Memorandum prepared by Geosyntec dated July 16, 2012 (Geosyntec, 2012a). The second expanded bench-testing phase is documented in the Phase II Bench-Scale Report (Geosyntec, 2013b).

The Phase I laboratory bench-scale testing was conducted using sodium persulfate and ozone. Soil samples were recovered from a representative location onsite that had TPH-impacts based on previous soil sampling data. The samples were sent to a feasibility testing laboratory to test the ability of that sodium persulfate and ozone to react with the TPH impacts in the soil.

Sodium persulfate was found not to be effective for treatment of TPH and PAHs. Geosyntec concluded that hydrocarbon treatment using high doses of sodium persulfate would not be effective for Site soils, and field-scale tests were therefore not conducted using this chemical oxidant.

The Phase I studies indicated that ozone treatment could be effective on Site soils (at the bench-scale level); however, the dose required for achieving greater than 90% treatment was very high and an excessive quantity of ozone would be required for field application. Additionally, ozone consumption rates were slow, presenting the potential for fugitive ozone emissions. As a result, field-scale pilot testing was not recommended based on feasibility analysis and modeling that was reported the Technical Memorandum summarizing Phase I results (Geosyntec, 2012a).

In response to the Regional Board's correspondence dated February 14, 2013, Geosyntec submitted a *Phase II ISCO Bench-scale Test Work Plan* on March 15, 2013 (Phase II Work Plan, Geosyntec, 2013a), and conducted a second expanded phase if ISCO pilot testing solely using ozone as an oxidant. Phase II ozone treatment bench-scale soil column tests evaluated the impact of varying ozone concentrations and flow rates, and thus doses, on the treatment of TPH in Site soils, to provide additional insight into the feasibility of in-situ chemical oxidation using ozone. The results indicated less than approximately 50% reduction in TPH concentrations was observed in the Phase II tests using lower flow rates and applied ozone doses.

As with the Phase I findings, Geosyntec concluded that effective field applications would require an excessive quantity of ozone to treat a single injection location, and that full-scale treatment would require an excessive quantity of ozone to achieve greater than 50% reduction in hydrocarbon mass. Therefore, field pilot testing of ISCO using ozone was not recommended based on both Phase I and Phase II findings, and was not considered as a possible remedial alternative.

5.0 REMEDIAL ACTION OBJECTIVES AND SITE-SPECIFIC CLEANUP GOALS

Media-specific (i.e. soil, soil vapor, and groundwater) Remedial Action Objectives (RAOs) have been developed for the Site, and numerical SSCGs for the COCs have been developed to achieve the medium-specific RAOs. These medium-specific RAOs and SSCGs, along with the Revised FS, including an analysis of economic and technological feasibility in accordance with SWRCB Resolution 92-49 and other ARARs, were used to identify the recommended response actions for each impacted medium that are proposed in this RAP.

Various demarcations of acceptable risk have been established by regulatory agencies. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 CFR 300) indicates that incremental lifetime cancer risks (ILCRs) posed by a site should not exceed a range of one in one million (1×10^{-6}) to one hundred in one million (1×10^{-4}) and that noncarcinogenic chemicals should not be present at levels expected to cause adverse health effects (i.e., a Hazard Index [HI] greater than 1). In addition, other relevant guidance (USEPA, 1991c) states that sites posing a cumulative cancer risk of less than 1×10^{-4} and hazard indices less than unity (1) for noncancer endpoints are generally not considered to pose a significant risk warranting remediation. The California Hazardous Substances Account Act (HSAA) incorporates the NCP by reference, and thus also incorporates the acceptable risk range set forth in the NCP. In California, the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) regulates chemical exposures to the general population and is based on an acceptable risk level of 1×10^{-5}. The DTSC considers the 1×10^{-6} risk level as the generally accepted point of departure for risk management decisions for unrestricted land use. Cumulative cancer risks in the range of 1×10^{-6} to 1×10^{-4} may therefore be considered to be acceptable, with cancer risks less than 1×10^{-6} considered *de minimis*. The risk range and target hazard index has been considered in developing RAOs and SSCGs based on human health exposures to soil and soil vapor. For groundwater and the soil leaching to groundwater pathway, water quality objectives in the Basin Plan to protect the designated beneficial uses, including municipal supply, have been considered.

5.1 REMEDIAL ACTION OBJECTIVES

The following RAOs are proposed for the Site based on the above and site-specific considerations:

- Prevent human exposures to concentrations of COCs in soil, soil vapor, and indoor air such that total (i.e., cumulative) lifetime incremental carcinogenic risks are within the NCP risk range of 1×10^{-6} to 1×10^{-4} and noncancer hazard indices are less than 1 or concentrations are below background, whichever is higher. Potential human exposures include onsite residents and construction and utility maintenance workers. For onsite residents, the lower end of the NCP risk range (i.e., 1×10^{-6}) and a noncancer Hazard Index less than 1 have been used.
- Prevent fire/explosion risks in indoor air and/or enclosed spaces (e.g., utility vaults) due to the accumulation of methane generated from the anaerobic biodegradation of petroleum

hydrocarbons in soils. Eliminate methane in the subsurface to the extent technologically and economically feasible.

- Remove or treat LNAPL to the extent technologically and economically feasible, and where a significant reduction in current and future risk to groundwater will result.
- Reduce COCs in groundwater to the extent technologically and economically feasible to achieve, at a minimum, the water quality objectives in the Basin Plan to protect the designated beneficial uses, including municipal supply.

A further consideration is to maintain residential land-use of the Site and avoid displacing residents from their homes or physically divide the established Carousel community.

5.2 SITE-SPECIFIC CLEANUP GOALS

Medium-specific SSCGs for soil, soil vapor, and groundwater have been designed to achieve these RAOs. The SSCGs were developed using the guidance documents and agency policies identified by the Regional Board in the CAO, as well as other applicable resources. The RWQCB has directed Shell to use the RWQCB-revised SSCGs in preparing the Revised RAP, Revised FS, and Revised HHRA (RWQCB, 2014d) and provided corrections for the SSCGs for total petroleum hydrocarbons as motor oil (TPHmo) and benzene in subsequent correspondence (RWQCB, 2014e). The RWQCB-approved and directed SSCGs for each medium are summarized below.

5.2.1 Soil

SSCGs for soil were calculated considering human health exposure pathways (i.e., risk-based SSCGs), and the leaching to groundwater pathway. Risk-based SSCGs were developed using a methodology and approach similar to that used to conduct the property-specific HHSREs. Risk-based SSCGs for the residential scenario are based on: (1) frequent exposure assumptions (350 days per year) for shallow soil (e.g., from 0 to 5 feet bgs), and (2) infrequent exposure assumptions (4 days per year) for soils at depth that residents are unlikely to contact more than a few times per year (e.g., from 5 to 10 feet bgs). Risk-based SSCGs for the construction and utility maintenance worker scenario are developed assuming exposures can occur to soil at depths from 0 to 10 feet below ground surface (bgs).

- The Soil SSCGs for residential exposures are chemical-specific numerical values for COCs assuming a target incremental cancer risk of 1×10^{-6} and a hazard quotient of 1. These numerical SSCGs are calculated for both frequent and infrequent exposure assumptions.
- The Soil SSCGs for construction and utility maintenance worker exposures are chemical-specific numerical values for COCs assuming a target incremental cancer risk of 1×10^{-5} and a hazard quotient of 1.
- The Soil SSCGs for the leaching to groundwater pathway are based on protection of groundwater as provided by the Regional Board (RWQCB, 2014d, e). Soil SSCGs for the leaching to groundwater pathway are chemical-specific numerical values for COCs directed by the Regional Board in their January 23, 2014 letter, as revised in the May 29, 2014 letter.

The soil SSCGs used in this Revised RAP are consistent with those listed in Table 1 of the January 23, 2014 RWQCB letter directing Shell to submit this RAP, as modified per the Regional Board's letter of May 29, 2014. Revised SSCGs for soil are listed in Table 5-1.

5.2.2 SSCGs for Sub-Slab and Soil Vapor

As directed in the January 23, 2014 RWQCB letter directing Shell to submit this RAP:

- Soil vapor and sub-slab soil vapor SSCGs for the residential exposures have been calculated using a vapor intrusion attenuation factor of 0.002. In response to comments received from the Regional Board, the sub-slab soil vapor data were re-evaluated considering more recent data, not subtracting the contributions of outdoor air from the indoor air results, and evaluating the contribution of background concentrations in an alternate quantitative manner. Based on the evaluation, an upper-bound vapor intrusion attenuation factor of 0.002 was used to derive sub-slab soil vapor SSCGs. In addition, as directed by the RWQCB (RWQCB, 2014d, e), a vapor intrusion attenuation factor of 0.002 was used to evaluate deeper soil vapor. The use of this default attenuation factor of 0.002 for the assessment of petroleum hydrocarbons detected in deeper soil vapor does not take into account the natural vadose-zone biodegradation that has been identified at the Site and will significantly over-estimate the potential for vapor intrusion for these data.
- Odor-based screening levels also have been developed and were considered in the preparation of this RAP. The odor-based screening levels for soil vapor published in the SFBRWQCB ESL documentation (SFRWQCB, 2013) are used in this RAP. Based on the comparison of the risk based SSCGs and odor based screening levels corrective action planning to address risk-based SSCGs will also address odor concerns.
- The SSCGs for construction and utility maintenance worker exposures are chemical-specific numerical values for COCs assuming a target incremental cancer risk of 1×10^{-5} and a hazard quotient of 1. These numerical SSCGs will be applied to soil vapor from 0 to 10 feet bgs. These numerical values are provided in Table 5-2.
- THMs are not considered with respect to soil vapor exposures because they are components of drinking water and are not Site-related COCs.

Details of the soil vapor SSCG calculations are provided in the Revised HHRA (Geosyntec, 2014c) and the results are presented in Table 5-2.

The SSCGs for methane are the same as those presented in the Data Evaluation and Decision Matrix (Geosyntec, 2010a) previously prepared for the Site. These SSCGs are consistent with Cal-EPA DTSC (DTSC, 2005) guidance for addressing methane detected at school sites.

Methane Level	Response
>10%LEL (> 5,000 ppmv or 0.5%) Soil vapor pressure > 13.9 in H_2O	Evaluate engineering controls
> 2% - 10%LEL (> 1,000 - 5,000 ppmv or 0.1 - 0.5%) Soil vapor pressure > 2.8 in H_2O	Perform follow-up sampling and evaluate engineering controls

This RAP describes the proposed response actions for areas where the methane RAOs are not met.

5.2.3 SSCGs for Groundwater

Because no current or future use of the shallow zone and Gage aquifers at or near the Site is anticipated due to high total dissolved solids, the restrictive controls on groundwater production associated with the adjudication of the West Basin, the thin nature of the Shallow Zone, and the lack of space for pumping related infrastructure in the overlying community, the following groundwater SSCGs are proposed for the Site (consistent with the RAOs):

- Remove or treat LNAPL to the extent technologically and economically feasible, and where a significant reduction in risk to groundwater will result, and
- Reduce concentrations of COCs in groundwater to the extent technologically and economically feasible to achieve, at a minimum, the water quality objectives in the Basin Plan to protect the designated beneficial uses, including municipal supply.

The groundwater SSCGs are presented in Table 5-3.

6.0 SUMMARY OF HUMAN HEALTH RISK ASSESSMENT

6.1 HHRA OVERVIEW

Geosyntec conducted a HHRA to estimate potential human health risks associated with COCs detected in soil, sub-slab soil vapor, and soil vapor at the Site that was submitted in conjunction with the March 2014 FS and RAP (Geosyntec, 2014a). The Revised HHRA has been modified to address comments by the Regional Board, OEHHA, and the Expert Panel and the Revised HHRA (Geosyntec, 2014c) is being submitted as a companion document to this Revised RAP. The objective of the HHRA was to evaluate potential human health impacts to onsite residents and onsite construction and utility maintenance workers prior to any remediation efforts at the Site (baseline condition). In addition, an evaluation of potential COC leaching from soil to groundwater was conducted using the Soil SSCGs for the leaching to groundwater pathway as provided by the Regional Board (RWQCB, 2014d, e). Cumulative estimates of incremental lifetime cancer risks and noncancer hazard indices have been evaluated across media to address the comments received by the Expert Panel (RWQCB, 2014d).

The methodology used in the HHRA was consistent with current USEPA, RWQCB, and DTSC guidance and incorporated the SSCGs presented in the Revised SSCG Report (Geosyntec, 2013c) as revised to address Regional Board comments. The HHRA used the SSCGs with the Site concentration data to develop a cumulative risk characterization for the Site addressing both potential human health risks and potential leaching to groundwater concerns. The HHRA is a predictive tool and is used in the remedial decision-making process to determine if further action is warranted for areas of the Site.

The HHRA addressed potential onsite exposures to residents and construction and utility maintenance workers. Potential exposures to COCs detected in shallow soils were evaluated for the direct contact pathways, as well as inhalation of volatile COCs in outdoor air and nonvolatile COCs in fugitive dust. Additionally, the potential for volatile COCs to migrate from the subsurface (using sub-slab soil vapor data) into residential structures present above ground was evaluated for a resident. Potential exposures to COCs in soil vapor were also evaluated for inhalation of vapors in outdoor air.

An initial step in the HHRA process is an evaluation of available data to identify media-specific COCs. A variety of samples have been collected as a part of the Site investigation process. Detected compounds include TPH, VOCs, SVOCs, PAHs and metals. These compounds, if they were detected in at least one sample in a given media (soil or soil vapor), were included in the COC selection process; however, due to the large number of soil samples collected (over 10,000) if a chemical had a frequency of detection less than 0.05 percent, it was not evaluated further in the Revised HHRA as a COC. A risk-based toxicity-concentration screen was then used to focus the list of COCs to those chemicals that have the potential to contribute significantly to potential risk at the Site (Geosyntec, 2013c). For the selection of soil COCs to address the leaching to groundwater pathway, chemicals that were detected in groundwater above their respective MCL or NL were carried forward into the HHRA. The COCs evaluated in the HHRA are consistent with the COCs

presented in the Revised SSCG Report with the addition of toluene and xylenes as directed by the Regional Board. Although there is no evidence that PCE and TCE are site-related COCs, PCE and TCE were included in the HHRA as directed by the Regional Board. Additionally, THMs that are likely associated with municipal water use have been included.

Metals and carcinogenic PAHs (cPAHs) may be associated with petroleum hydrocarbons, but are also naturally occurring in the environment. According to the DTSC (Cal-EPA DTSC 1997, 2009a, 2009c, 2009d) for naturally occurring materials such as metals and cPAHs, an evaluation of background concentrations is important to evaluate whether the metals concentrations at the Site are consistent with naturally occurring levels in the area, and whether they should be included in the HHRA. If concentrations of a metal or cPAHs are within background, these constituents are not considered a COC in the HHRA and are not evaluated further. The background analysis for the Site is summarized in the HHRA and presented in more detail in the Background Analysis Report (Appendix A to Geosyntec, 2014a). Metals and cPAHs were retained as COCs in the HHRA as appropriate based on the results of Site-wide toxicity-concentration screen and property-specific background analysis.

To evaluate potential human health risk or potential for leaching to groundwater, SSCGs presented in the Revised SSCG Report, as modified by the Regional Board (RWQCB, 2014d, e) were used. The SSCGs are presented in Tables 5-1, 5-2 and 5-3. These values were used to calculate cumulative ILCR and noncancer Hazard Indices estimates for each property and the streets for the exposure pathways and media presented above. For potential leaching to groundwater, the SSCGs were compared to the property-specific and streets soil data as well. The results of the cumulative human health risk and noncancer evaluation as well as the evaluation of potential leaching to groundwater were combined to form an overall risk characterization of each property.

For sub-slab soil vapor, SSCGs for residential exposures have been calculated using a vapor intrusion attenuation factor of 0.002 which is considered an upper-bound vapor intrusion attenuation factor. In addition, as directed by the RWQCB (RWQCB, 2014d, e), a default attenuation factor of 0.002 was used to evaluate deeper soil vapor data. The use of a default attenuation factor of 0.002 for the assessment of petroleum hydrocarbons detected in deeper soil vapor does not take into account the natural vadose-zone biodegradation that has been identified at the Site and will significantly over-estimate the potential for vapor intrusion for these data.

Properties that did not meet the RAOs were identified for further evaluation in the Revised FS and Revised RAP.

As discussed in Section 5, various demarcations of acceptable risk have been established by regulatory agencies. Under most situations, cancer risks in the range of 10^{-6} to 10^{-4} may be considered to be acceptable with cancer risks less than 10^{-6} considered *de minimis*. The NCP (40 CFR 300) indicates that lifetime incremental cancer risks posed by a site should not exceed a range of one in one million (1×10^{-6}) to one hundred in one million (1×10^{-4}) and noncarcinogenic chemicals should not be present at levels that have the potential to cause adverse health effects (i.e., a hazard index greater than 1). If the HI exceeds 1, there may be concern for potential noncarcinogenic health effects. However, an HI above 1 does not indicate an effect will definitely occur due to the margin of

safety associated with the exposure assumptions and chemical toxicity criteria used in health risk assessments. Also it should be noted that the scientific methods used in health risk assessment cannot be used to link individual illnesses to chemical exposures, rather health risk assessments are used as a predictive tool to evaluate theoretical risks for remedial decision making.

6.2 POTENTIAL RESIDENTIAL EXPOSURES

For soils at a depth of less than or equal to 2 feet bgs, a total of 87 properties were identified as having an exceedance of the lower bound of the risk range of 1×10^{-6} or an HI of 1. Seventeen properties had an exceedance of the ILCR of 1×10^{-6}. The ILCR estimates ranged from 2×10^{-6} to 2×10^{-5}, well within the risk management range of 10^{-6} to 10^{-4}. The primary COCs that contributed to the ILCR estimates were benzene, benzo(a)pyrene, ethylbenzene, 1-methylnaphthalene, naphthalene, and PCE (one property). Eighty-seven (87) properties were identified as having an exceedance of an HI of 1, ranging from 2 to 10, with two properties having values of 20 and 30. Thirty-five (35) of those properties had an HI of 2, marginally above the threshold of 1, and 33 of the 35 properties with no individual COC-specific HQ above 1. Another 32 properties had a value ranging from 3 to 5. The primary COCs that contributed to the HI estimates were TPHd and TPHmo. One property had a lead hazard quotient of 2, marginally above the HI of 1.

For shallow surface soils (≤5 feet bgs), 172 properties were identified as having an exceedance of the lower bound of the risk range of 1×10^{-6} or a hazard index of 1. (These include the 87 properties discussed in the previous paragraph.) Seventy-three (73) properties had an exceedance of the ILCR of 1×10^{-6}. The ILCR estimates ranged from 2×10^{-6} to 3×10^{-5}, well within the risk management range of 10^{-6} to 10^{-4}. Eleven ILCR estimates were at or above a risk level of 1×10^{-5}; 51 values were at or below 5×10^{-6}. The primary COCs that contributed to the ILCR estimates were benzene, cPAHs, ethylbenzene, 1-methylnaphthalene, naphthalene, PCE (one property) and vinyl chloride (one property). One hundred and seventy-two (172) properties were identified as having an exceedance of an HI of 1, values for 164 properties ranged from 2 to 10, with seven properties having a value of 20 and one property having a value of 40. Thirty-two (32) properties have a value of 2, marginally above the threshold of 1, and 27 properties with no individual COC-specific HQ above 1. Another 74 properties had a value ranging from 3 to 5. The primary COCs that contributed to the HI estimates were TPHd and TPHmo, with TPHd being the primary COC for 55 properties.

For subsurface soils (>5 to ≤10 ft bgs), no properties were identified as having an exceedance of the lower bound of the risk range of 1×10^{-6} or an HI of 1 for the infrequent contact residential exposure scenario.

In addition to the evaluation of incremental cancer risk and noncancer hazard, a property-specific background analysis was conducted for the Site COCs to determine if metals or cPAHs were present in soils above background levels. Metals and cPAHs considered above background were included in the estimates of risk and hazard summarized above with the exception of arsenic. For an additional five properties, arsenic was the only COC identified due to being above background. These properties should be considered further during remedial planning.

Based upon the multiple lines of evidence evaluations presented in the Follow-up Indoor Air Reports and Final Interim Reports, Geosyntec and URS concluded that constituents detected in indoor air are reflective of background sources. Notwithstanding the fact that regulatory guidance does not require remediation of COCs present at or below background levels, the RWQCB directed Shell to evaluate theoretical exposures due to the vapor intrusion pathway using the detected concentrations of COCs in sub-slab soil vapor. The Revised HHRA includes this vapor intrusion evaluation and theoretical exposures were calculated using conservative assumptions (e.g., sub-slab soil vapor to indoor air attenuation factor of 0.002).

For sub-slab soil vapor, 27 properties were identified as having an exceedance of the lower bound of the risk range of 1×10^{-6} or a HI of 1, not including the background risks associated with THMs. Trihalomethanes are not considered in the final risk characterization for soil vapor due to their presence as a result of municipal water use at the Site. The ILCR estimates for 25 properties ranged from 2×10^{-6} to 3×10^{-5}, well within the risk management range of 10^{-6} to 10^{-4}. Two ILCR estimates were at 1×10^{-4} and 2×10^{-3}, at and above the upper-bound of the risk management range of 1×10^{-4}. The property with the highest ILCR estimate is 378 E. 249th Street where elevated benzene concentrations were observed underneath the garage, and a sub-slab mitigation system was installed as an interim measure. The property with the second highest ILCR estimate is 24603 Marbella Avenue where elevated benzene concentrations were observed in one sample in the backyard during the first round of soil vapor sampling for that property. The result was not confirmed in the subsequent two sampling events in which benzene was not detected in any sub-slab soil vapor sample from the property. The primary COCs that contributed to the ILCR estimates were benzene, carbon tetrachloride, chloroform, ethylbenzene, methylene chloride, naphthalene, PCE, TCE and vinyl chloride (one property). Of the 27 properties that were identified, five properties had no individual COC-specific ILCR estimate above 1×10^{-6}. Two properties were identified as having an exceedance of a HI of 1, with values of 2 and 5. These two properties were also identified as having an ICLR exceedance of greater than 1×10^{-6}.

In response to comments received from the Expert Panel, cumulative cancer risk and noncancer hazard results were summed across all media, specifically soil less than or equal to 5 feet bgs along with sub-slab soil vapor, for an on-site resident. Only one property had cumulative risk greater than 1×10^{-6} (a value of 2×10^{-6}) when the media risks separately were less than 1×10^{-6}. However, this property is already identified for consideration due to an exceedance of the SSCG for leaching to groundwater and therefore potential cumulative risks for this property will be addressed as a part of the remedial action for soils.

6.3 Potential Construction and Utility Maintenance Worker Exposures

Construction and utility maintenance worker exposures were evaluated for both soil and soil vapor in two areas within the Kast Site: (1) within the individual property boundaries, and (2) within the Streets.

For soil, nine residential properties were identified as having an exceedance of the target risk of 1×10^{-5} or an HI of 1 when the data were analyzed using the construction and utility worker exposure scenario. The ILCR estimates ranged from 2×10^{-5} to 3×10^{-5}, well within the risk management range of 10^{-6} to 10^{-4}. The primary COC that contributed to the ILCR estimates was benzene. One hundred and thirty-eight (138) properties were identified as having an exceedance of an HI of 1, ranging from 2 to 10. Forty-one (41) of those properties have a value of 2, marginally above the threshold of 1. The primary COCs that contributed to the HI estimates were TPHd and TPHg, with TPHd the primary contributor at 116 properties.

For soil data collected in the streets, the ILCR was 2×10^{-5} with no individual COC having a risk greater than 1×10^{-5}. The noncancer HI estimate was 6 with TPHd as the primary contributors to the HI estimate. The lead hazard quotient was less than 1.

For soil vapor, no property had an ILCR greater than 1×10^{-5} or a noncancer HI greater than 1. For data collected in the streets the ILCR was 2×10^{-5} and the noncancer HI estimate was 0.04.

6.4 POTENTIAL SOIL LEACHING TO GROUNDWATER

An evaluation was conducted for the potential for COCs to migrate from the soil to underlying groundwater at the Site. For soil ≤5 ft bgs within the properties, 202 properties exceed the soil-leaching-to-groundwater SSCGs. TPHd, TPHg, TPHmo, benzene and naphthalene are the compounds with the most frequent exceedances in this depth interval. For soil >5 to ≤10 ft bgs, 174 properties exceed the soil-leaching-to-groundwater SSCGs. TPHd, TPHg, TPHmo, benzene and naphthalene are the chemicals with the most frequent exceedances in this depth interval.

For soil data collected in the Streets from ≤10 ft bgs, concentrations were compared to the soil-leaching-to-groundwater SSCGs. Using the maximum concentrations, 11 COC concentrations exceeded their respective soil leaching to groundwater SSCGs (1,2,3-trichloropropane, antimony, arsenic, benzene, cis-1,2-dichloroethene, naphthalene, PCE, thallium, TPHg, TPHd and TPHmo).

6.5 HHRA SUMMARY AND PROPERTIES PROPOSED FOR REMEDIATION

The results of the HHRA are presented graphically on Figures 6-1, 6-2 and 6-4. Table 6-1 presents the property addresses that exceeded the lower bound of the risk management range for ILCR and a noncancer hazard index of 1 for soil and sub-slab soil vapor, respectively. In addition, soil leaching to groundwater and metals present above background are considered. For sub-slab soil vapor, concentrations of methane were also considered. These properties along with impacts in the Streets are identified as not meeting the RAOs established for the Site and are considered further in the RAP. In addition, in response to RWQCB comments, soils between 5 and 10 feet bgs have been included for consideration in the Revised FS Report and Revised RAP for targeted excavation as shown on Figure 6-4.

The number of properties identified for consideration in the RAP are as follows:

Media	Depth	Number of Properties Considered in RAP
Soil	≤5 ft bgs	202
Soil	≤5 ft bgs and >5 to ≤10 ft bgs combined	224
Soil Vapor	Sub-slab	28[7]

[7] 27 properties were identified based on RAO exceedance for potential vapor intrusion, and one property was identified based on methane. In addition, while the data do not indicate that vapor intrusion is an issue at any of the residences, Shell is prepared to offer installation of a sub-slab mitigation system to any of the homeowners in the Carousel neighborhood to alleviate concerns about potential impacts to their indoor air from the Site.

7.0 SUMMARY OF FEASIBILITY STUDY

The remedial actions recommended in this Revised RAP emerged as the recommendation made in the Revised FS Report for the Site (Geosyntec, 2014d). The Revised FS Report, which is a companion document to this Revised RAP, includes identification and screening of a range of technologies, each of which can address a specific Site cleanup issue. Screening of technologies is followed in the Revised FS Report by identification, screening and detailed evaluation of a range of remedial alternatives for the Site. This section of the Revised RAP provides an overview of the FS process.

Each technology identified in the Revised FS Report is appropriate to address a specific Site cleanup issue. Technologies are identified in two categories: (1) Technologies that interrupt the human health exposure pathway, and (2) technologies that remove COC mass in addition to interrupting the human health exposure pathway. In the first category, the following technologies are identified:

- Sub-slab vapor intrusion mitigation, which may include the installation of passive barriers, passive venting, or active sub-slab depressurization;
- Capping portions of the Site, which involves the placement of cover over the impacted media;
- Removal of all Site features; and
- Institutional controls, which restrict access to impacted media.

Technologies which remove COC mass in addition to interrupting the human health exposure pathway include the following:

- Excavation:
    - Lifting and cribbing houses (assists in removing mass);
    - Temporarily moving houses (assists in removing mass);
    - Removal of residual concrete slabs if encountered;
    - Selected Excavation Around Existing Structures;
    - Targeted Excavation;
- Soil vapor extraction (SVE);
- Bioventing;
- In-situ chemical oxidation (ISCO);
- Mobile LNAPL/source removal;
- Monitored natural attenuation (MNA);
- Contingency in-situ groundwater remediation:

- Air sparging with SVE;
- Biosparging;
- Injection of oxidant (e.g., Oxygen Release Compound ®).

After screening, three technologies were eliminated from further consideration: In-situ chemical oxidation; lifting and cribbing houses to allow excavation beneath houses, and temporarily moving houses to allow excavation beneath houses. None of the remaining technologies alone constitutes a complete approach to Site cleanup. It is necessary to combine groups of technologies to develop a complete cleanup approach. Remedial alternatives, which are defined in the FS, represent such combinations of technologies. After preliminary remedial alternatives are defined in the FS Report, these alternatives are screened to assess those which represent realistic approaches to Site cleanup.

Remedial alternatives which remain after screening, and the specific technologies employed as part of those alternatives, are summarized below:

- Alternative 1 – No Action;
- Alternative 4 – Excavation of Site soils from both landscaped areas and beneath residential hardscape; existing institutional controls; SVE/bioventing; sub-slab mitigation; removal of LNAPL; and groundwater MNA and potentially supplemental active remediation. Four separate excavation alternatives in this category are evaluated in the FS Report:
  - Alternative 4B – Excavation to 3 feet bgs;
  - Alternative 4C – Excavation to 5 feet bgs;
  - Alternative 4D – Excavation to 5 feet bgs with Targeted Deeper Excavation to 10 feet bgs;
  - Alternative 4E – Excavation to 10 feet bgs.
- Alternative 5 – Excavation of Site soils from landscaped areas only; existing institutional controls; SVE/bioventing; sub-slab mitigation; removal of LNAPL; and groundwater MNA and potentially supplemental remediation. Four separate excavation alternatives in this category are evaluated:
  - Alternative 5B – Excavation to 3 feet bgs;
  - Alternative 5C – Excavation to 5 feet bgs;
  - Alternative 5D – Excavation to 5 fee bgs with Targeted Deeper Excavation to 10 feet bgs;
  - Alternative 5E – Excavation to 10 feet bgs.
- Alternative 7 – Capping the landscaped areas of the Site; existing institutional controls; SVE/bioventing; sub-slab mitigation; removal of LNAPL; and groundwater MNA and potentially supplemental remediation.

These remaining alternatives then are evaluated against a set of criteria that include the following:

- Overall protection of human health and the environment;
- Compliance with applicable or relevant and appropriate requirements (ARARs);
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, and volume through treatment;
- Short-term effectiveness;
- Implementability;
- Cost;
- State acceptance;
- Consistency with State Water Resources Control Board Resolution 92-49;
- Social considerations;
- Sustainability.

An additional criterion, Community Acceptance, will be considered following comment on the Revised FS Report and on the Revised RAP.

The RWQCB letter of January 23, 2014 makes clear that the Revised FS Report must meet the provisions of SWRCB Resolution 92-49. With respect to remedial activity, Resolution No. 92-49 focuses on impacts to water quality and not on all media. Waste in non-water media (such as soil) should be addressed through remediation to promote the attainment of background water quality (not, for example, background levels in soil) or the best water quality that is reasonably feasible given the considerations listed. Resolution 92-49 also includes the concept of technical and economic feasibility, in a manner that is distinct from the criteria of implementability or cost. Technological feasibility is determined by assessing available technologies which have shown to be effective under similar hydrogeologic conditions in reducing the concentration of the constituents of concern. Economic feasibility is an objective balancing of the incremental benefit of attaining further reductions in the concentrations of constituents of concern as compared with the incremental cost of achieving those reductions.

The recommended alternative is the alternative that meets the two threshold criteria (overall protection of human health and the environment and compliance with ARARs), and that best balances the remaining criteria. Alternative 4B meets the Resolution 92-49 criteria for protection of groundwater and is protective of human health. Shell concludes that the existing institutional control, further enhanced with a notification system, is fully protective of human health, and that Alternative 4B is adequately protective, but acknowledges that other alternatives that excavate to a deeper depth may be marginally more protective in the event of inadvertent residential excavation without seeking a City permit. After detailed evaluation and consideration of input from the RWQCB regarding protectiveness for potential residential activities and additional mass removal, the alternative that was recommended for further development in the Revised RAP was the following:

- Alternative 4D – Excavation of Site soils to 5 feet bgs from both landscaped areas and areas beneath residential hardscape; targeted deeper excavation to 10 feet bgs for mass removal; existing institutional controls; SVE/bioventing; sub-slab mitigation; removal of LNAPL; groundwater MNA and potentially supplemental remediation; and long-term monitoring.

Residual concrete reservoir slabs will be removed if encountered in excavations, to the extent practicable and if it can be done safely.

A more detailed description of this recommended alternative follows in Section 8 below.

8.0 RECOMMENDED REMEDIAL ACTIONS

Based upon the results of the Revised HHRA (Geosyntec, 2014c) and Revised FS (Geosyntec, 2014d), and in consideration of the Site characterization information summarized above, RAOs for the Site, the Regional Board's and Expert Panel's comments contained in the RWQCB correspondence dated April 30, 2014 and May 29, 2014, additional direction received from the Regional Board the following multi-media remedial actions are recommended for the Site:

- Excavation of shallow soils at impacted residential properties where RAOs and the more stringent of the health risk-based or leaching to groundwater criteria are not met under existing conditions. Excavation will be conducted to a depth of 5 feet bgs at accessible portions of both landscaped and hardscaped areas of residential yards from 202 properties (shown on Figure 6-1).
- Local targeted deeper excavations from 5 to 10 feet bgs at approximately 82 properties (shown on Figure 6-3) in areas where significant additional hydrocarbon mass can be removed. Excavations to 10 feet bgs will be at locations where TPH SSCGs are exceeded by a factor of 10 times or greater than the residual NAPL soil concentration and will be conducted using a combination of conventional and auger excavation methods.
- Residual concrete reservoir slabs will be removed if encountered in excavations, to the extent practicable and if it can be done safely.
- Landscaping and removed hardscape will be restored following excavation.
- A robust SVE/bioventing system, with SVE/bioventing wells in City streets and on residential properties, will be installed and operated to extract VOCs and methane and to promote degradation of residual hydrocarbon concentrations via bioventing where RAOs are not met following soil excavation. Bioventing will be integral with SVE via cyclical operation of SVE wells. Bioventing in concert with SVE will be used to increase oxygen levels in subsurface soils and promote microbial activity and degradation of longer-chain petroleum hydrocarbons.
- Sub-slab mitigation will be implemented at 28 properties (shown on Figure 6-4) where RAOs are not met and calculated vapor intrusion risk is greater than 1×10^{-6} using an attenuation factor of 0.002 or methane concentrations in sub-slab soil vapor exceed the upper RAO for methane of 0.5%. In addition, while the data do not indicate that vapor intrusion is an issue at any of the residences, Shell is prepared to offer installation of a sub-slab mitigation system to any of the homeowners in the Carousel neighborhood to alleviate concerns about potential impacts to their indoor air from the Site.
- Long-term monitoring of sub-slab soil vapor probes at properties scheduled for remedial excavation will be conducted until the SVE/bioventing system becomes operational and periodically thereafter. Monitoring will also be continued at select soil vapor probe locations in City streets and of utility boxes and other Site features previously monitored until the SVE/bioventing system becomes operational. Thereafter, monitoring will be conducted at newly installed shallow and multi-depth soil vapor probes.

- SVE/bioventing system operations and maintenance (O&M) and system effectiveness sampling will be conducted periodically.
- LNAPL will be recovered where it has accumulated in monitoring wells MW-3 and MW-12 and in additional wells if it accumulates at a measurable thickness, to the extent technologically and economically feasible, and where a significant reduction in current and future risk to groundwater will result.
- COCs in groundwater will be reduced to the extent technologically and economically feasible via source reduction and monitored natural attenuation (MNA). MNA could be paired with contingency groundwater remediation of oxidant injection in areas where Site-related COCs exceed 100x MCL if, after a five-year review following start of SVE/bioventing operations, the groundwater plume is not stable or decreasing. In addition, upgradient sources would need to be addressed by the overseeing agencies.
- The shallow soil remedy includes a Surface Containment and Soil Management Plan to address notifications, management, and handling of residual soils below the depth of excavation and that are impacted by COCs at concentrations greater than risk-based levels. Soils remaining below 5 feet bgs and impacted soils beneath City streets and sidewalks will be addressed through the Surface Containment and Soil Management Plan (Appendix C). Implementation of the Surface Containment and Soil Management Plan can be accomplished through the City of Carson permitting process, as the Carson Municipal Code is an existing institutional control that requires that a Grading Permit be obtained for excavations deeper than 3 feet. In addition, Shell will implement a community outreach program to inform and educate residents in the community of residual impacted soils and of the notification procedures for management of these materials via the Surface Containment and Soil Management Plan.

These remedial actions are intended to achieve the RAOs and the RWQCB-approved SSCGs for soil, soil vapor, and groundwater as directed in the Regional Board's Review of the Revised SSCG Report and Directive dated January 23, 2014 and Review of the March 10, 2014 RAP, HHRA and FS dated April 30, 2014, and SSCG clarification letter dated May 29, 2014.

Although there is no indication that there are any long-term health risks or water quality concerns caused by COCs associated with residual concrete slabs, the recommended remedy for the Site, as summarized above and described in detail in subsequent sections of this RAP, would remove residual concrete slabs where practicable, and where it can be done safely, if encountered during excavation. Operation of the SVE/bioventing system would address any concerns at the Site related to COCs that may be associated with the residual reservoir slabs left in place.

Figures 8-6 and 8-7 provide conceptual rendering of completed remediation at a typical property in plan view (Figure 8-6) and cross-section view (Figure 8-7).

In accordance with the California Environmental Quality Act (CEQA), an Environmental Impact Report (EIR) is being prepared by the RWQCB as the lead agency. The EIR will analyze the potential environmental impacts associated with the recommended remediation alternative.

There remain approximately 13 properties for which access has not been granted and no sampling has been completed. Sampling will be conducted as access is granted to these properties, and the results will be analyzed consistent with the approach described above to determine what remedial measures, if any, will be taken.

8.1 APPROACH FOR EXCAVATION OF SHALLOW SOILS

Shallow soils will be excavated from residential properties where results of the Revised HHRA indicate that RAOs are not met under existing conditions. Shell will excavate shallow soils to a depth of 5 feet below existing grade in landscaped and hardscaped areas at identified properties (shown on Figure 6-1), subject to setback requirements to protect structures and certain utilities. Residual concrete slabs will also be removed if they are encountered in the excavations and can be safely removed. Based on Revised HHRA findings and evaluation of potential for COCs to leach to groundwater using Regional Board-directed SSCGs, 202 properties have been identified for remedial excavation (see Section 8.1.1). Shell maintains that the existing institutional control, further enhanced with a notification system, is fully protective of human health and that the previously recommended shallow excavation to 3 feet bgs is adequately protective but acknowledges that other alternatives that excavate to a deeper depth may be marginally more protective in the event of inadvertent residential excavation without seeking a City permit. Excavation to 5 feet bgs is recommended as a conservative measure based on Regional Board and Expert Panel comments and in consideration of the State Acceptance criterion.

Soils will be excavated from both landscaped areas and areas currently covered by hardscape, including walkways, driveways, patio areas, and hardscape associated with landscaping. Excavation areas at individual properties will be dependent on setback requirements established by the Geotechnical Engineer and approved by the L.A. County Department of Public Works and City of Carson. Per requirements of the local water purveyor, Cal-Water, setbacks will also be required from transite pipe water mains that are located at a depth of approximately 3 to 3.5 feet in front yards of the west side of north-south trending streets and the south side of east-west trending streets. Setbacks will also be required from power poles located along rear property lines and will be established in consultation with Southern California Edison. Exceptions to excavation beneath hardscape include patios covered by structures and roofs, and swimming pools and pool decking surrounding swimming pools. These hardscape areas will not be excavated to avoid structural demolition and potential damage to swimming pools and appurtenant equipment. In addition, property-specific features may limit excavation in some localized areas and this will be considered as the individual Property-Specific Remediation Plans are developed. No excavation will occur beneath City streets and sidewalks or beneath houses. In addition to treatment by the SVE/bioventing system discussed below, remaining soils in these non-excavated areas are addressed in the Surface Containment and Soil Management Plan (Appendix C) and by existing institutional controls.

Hardscape and landscaping will be removed during the initial stage of excavation and restored to like conditions following completion of excavation in consultation with the homeowner. Shell also anticipates that it will be necessary to remove most fences and block walls between yards and ornamental or partitioning walls on individual properties, as the depth of excavation will exceed fencepost and footing depths. Additionally, the distance between adjacent houses is approximately 7 to 10 feet, depending on fireplace and water heater locations, and removal of fences and walls separating side yards will facility equipment access to back yards. As with other hardscape, fences and walls will be restored following completion of excavation prior to restoration of landscaping.

Residents will be provided temporary living assistance while active excavation, backfill, and hardscape restoration work are being implemented (see Preliminary Relocation Plan, Appendix D).

Excavation to 5 feet bgs is consistent with the approach described in the Regional Board's Review of the Revised SSCG Report and Directive dated January 23, 2014, comments in its April 30, 2014 letter on the March 10 RAP, and in the interest of State Acceptance. In its' January 23, 2014 letter commenting on the Revised SSCG Report, the Regional Board stated:

> "…defining the uppermost soil interval from zero to five feet is supportive of unrestricted residential use because institutional controls are already in place throughout Los Angeles County, including the City of Carson and Carousel Tract for excavations that are deeper than five feet. These controls require a soils investigation as well as grading and shoring permits in order to excavate at depths below five feet. In the Carousel Tract, the Los Angeles County building code is administered by the City of Carson. Because the City must be notified and approve excavations below five feet (Los Angeles County Building Code Sections 3304.1.2, 3307.1, 1803.5.7, J103, J104) the City could readily inform residents and workers of other appropriate precautions necessary for excavations below five feet through existing administrative processes."

Additional information regarding the proposed shallow excavation remedy is provided in the following sections.

8.1.1 Identification of Properties for Remedial Excavation to 5 Feet bgs

Findings of the Revised HHRA with respect to potential impacts to human health and potential for COCs to leach to groundwater were used to identify properties that will require remedial excavation. In total, 202 properties were identified for remedial excavation to 5 feet bgs as discussed in Section 6.5 and summarized in Table 6-1 and shown on Figure 6-1.

As summarized in Section 6.3.1 of the Revised HHRA and Section 6.2 of this Revised RAP, for soils ≤5 ft bgs, 172 properties were identified as having an exceedance of the lower bound of the risk range of 1×10^{-6} or a hazard index of 1. The ILCR estimates ranged from 2×10^{-6} to 3×10^{-5}, well within the NCP risk management range of 10^{-6} to 10^{-4}. The primary COCs that contributed to the ILCR estimates were benzene, carcinogenic PAHs, ethylbenzene, 1-methylnaphthalene, naphthalene, PCE (one property) and vinyl chloride (one property). One hundred and seventy-two (172 properties

were identified as having an HI exceeding 1; values for 164 properties ranged from 2 to 10, with seven properties having a value of 20 and one property having a value of 40. The primary COCs that contributed to the HI estimates were TPHd and TPHmo, with TPHd being the primary COC for 55 properties.

The Revised HHRA also evaluated the potential for COCs to migrate from the soil to underlying groundwater at the Site. For residential soil ≤5 ft bgs, 202 properties exceed the soil-leaching-to-groundwater SSCGs. TPHd, TPHg, TPHmo, naphthalene, and benzene are the COCs with the most frequent exceedance in this depth interval. The property-specific results indicating properties identified for excavation to 5 feet bgs are presented in Table 6-1 and shown on Figure 6-1.

A total of 10 properties were identified as having metals present above background due to the presence of arsenic, antimony, or thallium. These properties have been identified for shallow soil excavation of soils from ≤5 ft bgs. The data were reviewed with respect to depth interval to evaluate whether the presence of these metals at concentrations above background would be addressed through shallow excavation or remain at depths from >5 to 10 feet bgs and pose a potential for leaching to groundwater.

Antimony was present above background levels at one property, but detections above background concentrations are present in shallow surface soil and will be addressed by excavation.

Arsenic was present above background levels at five properties and thallium was present above background levels at four properties at depths >5 to 10 feet bgs. The detections of arsenic and thallium above background are localized and do not represent a significant mass for leaching to groundwater. Leaching of arsenic and thallium to groundwater is not expected to be above what would occur for background soils. However, groundwater will continue to be monitored to assess whether an increase in arsenic or thallium concentrations due to the leaching pathway is occurring.

Based on hydrocarbon mass estimates developed for the Revised FS, removal of soils to a depth of 5 feet from accessible areas at these 202 properties would result in an approximately 11% reduction in hydrocarbon mass estimated to be present in the upper 10 feet of Site soils (see Section 5.2.3 of Revised FS). When compared to the total estimated hydrocarbon mass at the site from ground surface to the depth of groundwater, the excavated mass to 5 feet bgs would represent approximately 3% of the total hydrocarbon mass at the Site.

8.1.2 Identification of Properties for Targeted Deeper Excavation from 5 to 10 Feet bgs

Based upon the Regional Board's directive and Expert Panel's comments, an alternative that evaluates local targeted excavation to 10 feet bgs was included in the Revised FS and is presented here in the Revised RAP. The Revised FS evaluated the feasibility of local targeted removal of soils from 5 to 10 feet bgs using a combination of conventional excavation with small to medium-sized tracked excavators or tractor-mounted backhoes, such as the methods pilot tested (URS, 2013a, b, d), and soil removal using limited access bucket auger drilling to accomplish this additional mass

removal and found that, although difficult to implement at a large scale, deeper excavation could be accomplished.

Targeted excavation areas have been identified where, based on distribution of hydrocarbon impacts in the upper 10 feet, the potential exists for substantial hydrocarbon mass removal via deeper excavation. This excavation scenario entails removal of impacted soils from 5 to 10 feet bgs at residential properties in localized areas. It is recommended that these additional excavations be performed where practicable at targeted areas where constituents are present at 10 times the TPH SSCGs for leaching to groundwater or greater than the residual NAPL soil concentration (e.g., 50,000 mg/kg for TPHmo). Properties identified for targeted deeper excavation from 5 to 10 feet bgs are summarized in Table 6-1 and shown on Figure 6-3. Some properties were identified for excavation of both front and back yards, while others were identified for excavation of only the front or back yard.

The recommend values for definition of targeted deep excavation locations are 1,170 mg/kg for TPHg, 6,250 mg/kg for TPHd and 50,000 mg/kg for TPHmo. The TPHmo value is equal to the residual NAPL saturation concentration because 10 times the TPHmo SSCG of 10,000 mg/kg would result in a higher concentration and typically in these instances cleanup goals are capped at residual saturation concentrations.

The use of a 10-fold factor is based on regulatory precedence from Oregon and Massachusetts. The pertinent citations from the environmental regulations from each state are provided in footnotes below.

The state of Massachusetts[8] defines areas of localized elevated concentrations or hot spots (as referenced in the regulations) as: (a) discrete areas where the average concentration within the area is greater than 10 but less than 100 times the average concentration in the immediate surrounding area, unless there is no evidence that the discrete area would be associated with greater exposure potential than the surrounding area. In all cases, a discrete area where the concentration of an oil or hazardous material is greater than 100 times the concentration in the surrounding area is considered a hot spot. Thus, the recommended factor of 10 times the SSCG values is at the low end of the range used by Massachusetts.

The state of Oregon[9] defines hot spots of contamination for media other than groundwater or surface water as presenting a risk to human health or the environment exceeding (i) 100 times the acceptable risk level for human exposure to each individual carcinogen; (ii) 10 times the acceptable risk level for human exposure to each individual noncarcinogen; or (iii) 10 times the acceptable risk level for exposure of individual ecological receptors or populations of ecological receptors to each individual

[8] http://www.mass.gov/eea/agencies/massdep/cleanup/regulations/310-cmr-40-0000-mcp-subpart-a-general-provisions.html

[9] http://arcweb.sos.state.or.us/pages/rules/oars_300/oar_340/340_122.html

hazardous substance. The Oregon guidance would also support using a factor of 10 times the SSCG values or greater than the residual NAPL soil concentration to define hot spots.

Concentrations equal to 10 times the respective SSCGs for TPHg and TPHd, and the residual NAPL soil concentration (e.g., 50,000 mg/kg) for TPHmo were used to identify locations for deeper excavations using results of the 3-dimensional modeling conducted for the Site as discussed in Section 5.2.1 and Appendix A of the Revised FS Report. All of the Site TPH soil data (TPHg, TPHd and TPHmo) were used from ground surface to groundwater to develop a 3-dimensional model of the distribution of TPH in the subsurface using krigging to interpolate between known data points (i.e., sample collection points). A horizontal slice from 5 to 10 feet bgs was then taken from the 3-dimensional model, and this 5 to 10-foot distribution was plotted 2-dimensionally to define areas where 10X SSCGs for TPHg and TPHd and 50,000 mg/kg for TPHmo are exceeded. This distribution is shown as a series of gray areas on Figure 6-3 along with properties identified for targeted deeper excavation. Because of the nature of the interpolation, the shaded gray areas do not necessarily mean that TPH is present in all areas within the gray shading at concentrations above 10 times SSCGs. Properties were identified where a significant amount of mass could be removed based on visual interpretation of the areal extent of impacts exceeding 10 times SSCGs or greater than the residual NAPL soil concentration and residential property boundaries. Small areas of exceedance that were due to one or a limited number of samples and where significant mass could not be removed were not identified for excavation. Additionally, properties were not included if they had not been identified for excavation to 5 feet bgs (see Section 8.1.1).

In total, 82 properties were identified for targeted deeper excavation, 33 of these properties were identified for excavation in accessible portions of both front and back yards, 20 for excavation in front yards only, and 29 for excavation in back yards only. Based on the modeled hydrocarbon distribution, the entire accessible areas would be excavated, subject to required setback distances, in some yards, and partial areas of yards would be excavated at some properties. These areas where TPH is present at greater than 10 times SSCGs and identified properties are shown on Figure 6-3. A list of property addresses identified for deeper excavation is provided in Table 6-1.

The Revised FS estimated that the additional hydrocarbon mass that could be removed by localized targeted deeper excavation from 5 to 10 feet bgs in these areas represents approximately 23% of the total mass present in the upper 10 feet of soils at the Site and approximately 6% of the total hydrocarbon mass from ground surface to groundwater at the Site. In combination, excavation to 5 feet bgs at 202 properties and targeted deeper excavation from 5 to 10 feet bgs at an additional 82 properties for mass removal would result in removal of approximately 34% of the total mass in the upper 10 feet of soils at the Site and approximately 9% of the total hydrocarbon mass from ground surface to groundwater at the Site.

8.1.3 Mass Removal Estimates

As discussed in Section 5.2.3 of the Revised FS, Geosyntec prepared estimates of the total mass of petroleum hydrocarbons quantified as TPHg, TPHd, and TPHmo using 3-dimensional modeling that employed krigging to interpolate between known sample data points. The detailed basis for that estimate is provided in Appendix A of the Revised FS.

Provided below is an estimate of the amount of mass that would be removed and the amount of mass that would be left in place based on the remedial excavation alternative summarized above. It should be noted that these mass estimates are for the excavation part of the recommended remedy. Significant further mass removal will occur through SVE/bioventing which will be implemented Site-wide upon completion of the excavation program.

The total hydrocarbon mass in the upper 10 feet at the Site was estimated to be 4,330,000 pounds, and the total mass from ground surface to approximately 50 feet was estimated to be 16,500,000 pounds. The estimated mass removal for excavation to 5 feet bgs at the 202 identified properties was estimated at 480,000 pounds, or about 11% of the total mass in the upper 10 feet and 3% of the total mass from ground surface to approximately 50 feet. The additional mass that would be removed by targeted deeper excavation at 82 identified properties was estimated to be 1,010,000 pounds, which represents approximately 23% of the total mass in the upper 10 feet at the Site and 6% of the total mass from ground surface to approximately 50 feet. In combination, excavation to 5 feet bgs at 202 identified properties and targeted deeper excavation from 5 to 10 feet bgs at 82 identified properties would remove approximately 1,490,000 pounds of hydrocarbon mass (approximately 34%), leaving 2,840,000 pounds of hydrocarbons in the upper 10 feet of the Site and approximately 15,010,000 pounds of mass from ground surface to approximately 50 feet bgs.

8.1.4 Planning for Excavation Design

Following approval of the RAP, a Remedial Design and Implementation Plan (RDIP) will be prepared, as discussed in Section 9. In addition to the RDIP, a separate Property-Specific Remediation Plan (PSRP) will be prepared for each property. A property survey will be conducted by a California-licensed Professional Land Surveyor to document existing conditions within the Carousel tract in general and at each parcel that will include property boundaries, Site elevations and grade, building location(s), existing hardscape and landscaping, and underground and overhead utilities that encroach into that parcel.

The PSRPs will define areas to be excavated, features to be removed and those that will be protected in place, and locations of underground utilities that need to be either protected in place or removed and restored. The PSRPs will also identify the types of equipment and excavation approach for each property (e.g., use of standard excavating equipment, auger excavation, or a combination of equipment).

A geotechnical evaluation will be conducted and grading plans prepared as part of each RDIP. For properties planned for targeted deeper excavation to 5 to 10 feet bgs, the geotechnical evaluation will include drilling and sampling of a soil boring to collect samples for soil index and strength properties testing (see Section 8.1.3.1 below).

Utilities present in the Carousel community that may need to be avoided or temporarily interrupted are summarized below. These utilities will be identified and provisions made to protect them in place or remove and reinstall as part of the RDIP and PSRP processes.

- Water service to the neighborhood is provided by California Water Service Company (Cal-Water). Water mains are located on residential properties approximately 3.5 feet in from the inner edge of the sidewalk on the west side of north-south trending named streets and 3.5 feet in from the inner edge of the sidewalk on the south side of east-west trending numbered streets at approximately 3 to 3.5 feet bgs. The water mains are of asbestos-cement (transite) pipe construction, and according to Cal-Water, these water mains will need to be avoided and not exposed in excavations. This will limit excavation in the immediate area of the water mains to allow for vertical and lateral setbacks of approximately from the pipelines. Setback distances from the water mains will be established in consultation with Cal-Water during preparation of the RDIPs.

  Water service laterals to houses where excavations are conducted in front yards either will be protected in place in a manner similar to what was done during pilot test excavations or will be capped, removed and replaced.

- Based on the 5-foot depth of excavation, sewer laterals at some properties may be affected. If sewer laterals are present within the 5-foot or targeted deeper 5 to 10-foot excavations, they will be capped, removed and replaced.

- Gas mains located in City streets will not be affected by excavation work. Gas service laterals to houses where excavations occur in front yards will be protected in place or will be capped, removed, and replaced when excavation is completed and excavations have been backfilled.

- Sewer, water, and gas lateral line work will be conducted by a licensed contractor in accordance with City of Carson and Southern California Gas Company requirements.

- Telecommunications service trunk lines are located in a common trench with gas mains in the street or beneath the sidewalks and will not be affected by the work. Telecommunications lines to houses where excavation occurs in front yards may need to be removed and replaced. Shell has assumed that replacement of telecommunications lines will be done by an AT&T contractor that routinely does telephone cable work in the neighborhood.

- Electrical power is provided by Southern California Edison to homes in the Carousel tract by overhead lines that drop via lines to the roof line of houses from power lines along the back property lines of each block. The power lines are supported by wooden power poles located in back yards near the back lot line. Depending on overhead clearance and the specific equipment to be used for excavation at individual properties, it may be necessary to remove and replace the drop lines leading from the power poles to the houses. If this is necessary, power to the residence will be interrupted during the excavation and backfill process. Required setback from the power poles, maximum allowable excavation depths adjacent to the poles, and back-cut sloping requirements to protect the power poles will be established in consultation with Southern California Edison and the Geotechnical Engineer.

As part of RDIP and PSRP preparation, Shell contractors will meet with homeowners, and their legal representatives as appropriate, to obtain necessary information for relocation during remedial implementation and to discuss hardscape and landscape restoration. During this meeting, existing

landscape irrigation systems will be documented so that they can be restored as part of landscape restoration. In some cases, Shell may provide alternative landscape restoration from existing conditions if desired and agreed to by the homeowner, or as required by City Code. If during this meeting the homeowners express a desire that existing landscaping (such as a mature tree or shrubs) or hardscape not be removed from their property, an option will be discussed of leaving landscape elements or hardscape in place with the homeowners agreeing to enter into a Land Use Covenant (deed restriction) that would be recorded with the County Recorder's Office advising of the potential presence of impacted soil beneath hardscaped areas. If the landscaping or hardscape is removed in the future and potentially impacted soils below the area are exposed, they would be managed in accordance with the Surface Containment and Soil Management Plan (Appendix C).

8.1.4.1 Geotechnical Evaluations

In order to develop soil geotechnical parameters for design of excavation slopes, setbacks, and possible shoring systems at properties planned for targeted deeper excavation to 5 to 10 feet, a soil boring will be advanced to approximately 20 feet bgs at each property to collect relatively undisturbed samples for soil index properties and strength testing. The borings will be drilled using a hollow-stem auger drilling rig, and relatively undisturbed samples will be collected. Due to drill rig access considerations, the geotechnical borings will be located in front yards of the properties identified for targeted deeper excavation. The presence of the concrete reservoir bases will likely require coring of the concrete to allow sampling below the reservoir bottom. Upon completion, the boreholes will be backfilled using high-solids cement/bentonite grout from the bottom of the boring to 10 feet bgs and with hydrated bentonite from 10 feet bgs to the ground surface.

Laboratory tests will be conducted to evaluate soil index properties and shear strength parameters of subsurface soils. Laboratory tests will include in-situ moisture content and dry density (ASTM International [ASTM] D 2937), Atterberg limits (ASTM D 4318), sieve analysis (ASTM D 422), direct shear test (ASTM D 3080), and expansion index (ASTM D 4829).

A geotechnical evaluation will also be prepared for properties planned for excavation to 5 feet bgs; however, these evaluations will rely on existing hand-auger boring data and data from geotechnical borings advanced at locations for targeted deeper excavation and will not have geotechnical borings conducted. Based upon these geotechnical evaluations, the PSRPs will include planned excavation slopes and/or setbacks from existing structures or other features, such as around building foundations, as required by the Geotechnical Engineer and in accordance with City and County requirements.

The geotechnical investigation will need to be completed before finalizing excavation designs, including sidewall slopes, setbacks from structures, and shoring design, as applicable. The geotechnical investigation will precede preparation of grading plans and Grading Permit Applications to be submitted to the City of Carson and LACDPW.

8.1.5 General Excavation Approach

8.1.5.1 Utilities

Prior to starting demolition of existing landscaping and hardscape and initiation of excavation, a subcontracted private utility-locating geophysical contractor will locate and identify potential subsurface obstructions. Utility lines will be clearly marked in the field for removal or avoidance.

Hand excavation will be utilized to confirm the location and depth of the transite pipe water mains located in the front yards of approximately one-half of the properties. Shell anticipates working closely with Cal-Water on this aspect of the utility location work. Other underground utilities will be located, as deemed necessary, by hand excavation "potholing."

8.1.5.2 Proposed Excavation Methods and Equipment

Excavation will be conducted using conventional rubber track-mounted excavators or rubber-tired backhoes. Contractors will utilize the smallest, quietest equipment capable of effectively and safely completing planned excavation tasks. Based on performance during the excavation pilot tests, an approximately 15,000 to 18,000 pound medium-sized excavator would be effective for work in front yards and back yards where sufficient access is available, and a small approximately 3,500-pound rubber track-mounted mini-excavator was shown to be effective for work in back yards with narrow access via side yards. Side yard access will be significantly improved if work can be done sequentially on adjacent properties and the fence between the side and back yards of the properties can be removed, allowing larger equipment access to back yards. Excavation and soil management will also be conducted using a front-end loader and/or Bobcat skid-steer mini-loader to move soil from back yards to front yards and *vice versa* to bring in clean fill soil.

In some areas where targeted excavation from 5 to 10 feet is conducted, a limited access bucket auger drilling rig will be used in conjunction with conventional excavation equipment. Conventional excavation using slot-trenching as necessary to protect structures or other features and open bulk excavation with appropriate sloping, setbacks, and/or shoring will be used where possible as the preferred excavation method. Auger excavation using a limited access rig has the advantage of being able to work in relatively tight spaces adjacent to structures to remove a column of soil. Maximum bucket width of limited access auger rigs identified is 3 feet. Conceptually, using this approach, a 3-foot diameter borehole would be excavated and then backfilled with controlled low strength material[10] (CLSM, also referred to as sand-cement slurry) and allowed to cure overnight. The adjacent column would then be excavated and backfilled with CLSM the following day. A row of boreholes can be completed and filled, for example adjacent to a structure, and, if necessary, a second row of boreholes could be completed adjacent to the first row with the centers of the boreholes offset to achieve maximum soil removal. Using this approach it is possible to remove

[10] CLSM can be designed to have low enough compressive strength to allow excavation with hand tools and a range of permeability to air and liquids. It will be necessary to design the CLSM mix to have permeability comparable to that of surrounding soils in order to effectively operate the SVE/bioventing systems.

approximately 90% of soil from an area. A schematic rendering showing how this approach could be used is shown on Figures 8-6 and 8-7. While technically feasible, auger excavation is very slow and approximately three times more expensive than conventional excavation. Use of this method would also require re-excavating the upper approximately 3 to 5 feet of CLSM fill material and replacing it with clean import soil, unless the auger excavation is in an area that will be covered with hardscape. Auger excavation would therefore be used in limited application in favor of conventional excavation wherever possible.

Because auger excavation has not been used previously at the Site, Shell plans to conduct an auger excavation pilot test during preparation of the RDIP. Access will be sought at a property that overlies the former concrete reservoir base so that both auger removal of soil and augering or coring through the reservoir base can be pilot tested. This pilot testing will include evaluation of methods to control vapors and odors during soil removal and to manage potential accumulation of methane in boreholes while augering or coring the concrete reservoir base.

In areas where access to equipment is severely limited, excavation will be accomplished using a mini-excavator, and where necessary hand tools and wheelbarrows will be used to conduct excavations. Hand excavation may be required on side yards where there is insufficient room for equipment to operate. Depth of excavation using these methods is restricted to 5 feet bgs.

Other equipment that likely will be used during excavation and backfill operations includes:

- A water truck or water buffalo for dust control;
- Electrical generator(s);
- Mechanical and/or vibratory soil compaction equipment;
- Odor suppressant foam system (tank, compressor, foam generator and pump);
- Meteorological station;
- Organic vapor and dust monitoring equipment; and
- Employee comfort stations.

Excavations will be made with setbacks from structures and/or side slopes at the horizontal to vertical ratio recommended by the Geotechnical Engineer and approved by the LACDPW and City of Carson in the Grading Permit for the particular property being excavated. The basic excavation protocols will be altered as needed as excavations are conducted and to address any previously unknown utilities, concrete debris or foundations unearthed. If possible and approved by the LACDPW and City, the 5 foot excavations will have vertical sidewalls to maximize removal of impacted soils to the full depth of excavation. We anticipate that excavation sidewalls will be sloped below foundation footings of structures. However, it is possible that the LACDPW and City will require setbacks from structures in accordance with appropriate elements of Sections J101, J104, J106, and J108 of the County Grading Code as amended by the City of Carson.

If remnants of the former reservoir concrete sidewalls and bases are encountered in remedial excavations, the concrete will be removed where encountered in the upper 5 feet of the excavations. At locations where targeted deeper excavations extend from 5 to 10 feet bgs, the concrete reservoir slabs will be removed where encountered, to the extent practicable and where it can be done safely. Based upon discussions with drilling contractor personnel, the limited access auger rig should be capable of drilling through concrete rubble and coring through the concrete slab. The ability to use the auger rig to remove the concrete slab will need to be proven in a pilot test. If it is not possible to safely remove the slab using this excavation technique, the concrete will not be removed in areas excavated using the auger excavation method. If encountered concrete extends laterally beneath a structure or beneath the sidewalk, it will be cut at the edge of the structure or inner edge of the sidewalk and the remaining concrete will be left in place.

As currently envisioned, excavation will proceed in phases, with each phase of work including approximately eight contiguous properties, if access can be obtained. Where possible, each phase will include homes on both sides of a city block (e.g., the east side of Marbella and west side of Neptune Avenues or the west side of Ravenna and east side of Panama Avenues). This approach will be used so that back-of-lot fences or block walls can be removed one time and excavation conducted in both yards before the fences are restored. Removal of the side and back fences/walls will also facilitate equipment access and ability to conduct bulk excavations rather than more time consuming slot trenching.

Each phase will include approximately eight properties with work occurring on properties in sequence. For properties on the perimeter of the tract, work will likely proceed at a smaller number of properties for each phase. Assuming City approval of the number of daily truck trips, excavation will occur concurrently on four properties. By excavating on four properties concurrently, the overall duration to complete remedial excavation is shortened and excavations can be accomplished more efficiently. Preliminarily, based on working five days per week, it is estimated that excavation and backfill will take approximately six weeks per property and site restoration will take an additional approximately two weeks; approximately 10 weeks will be needed to complete a phase of eight properties. This is a preliminary estimate that will be refined during preparation of the RDIP and confirmed during implementation of the initial phases of work. Work on the second phase of properties (i.e., the next eight properties working down the block), will begin approximately at the end of week six or eight of work on the first phase.

As described in the Preliminary Relocation Plan (Appendix D), residents of properties where remedial excavations are being conducted will be relocated for the duration of the remedial excavation, backfill, and hardscape restoration operations. Following backfill and utility and hardscape restoration, residents would move back into their homes during landscape restoration and fence/block wall construction, or, at their option, wait to return until after the landscape restoration work is completed. For non-excavated properties adjacent to properties where excavation work is being conducted, residents of adjacent properties and will be offered relocation as necessary.

This phased excavation approach will require that access can be obtained and Grading Permits for the properties are available for all eight properties in a phase before work commences. In the event that

a property does not require excavation, that property will be skipped in the sequencing of work; however, side yard and back property fences likely will need to be removed to allow excavation of the adjacent properties. The efficacy of this phased approach depends upon residents of the affected properties providing access to allow the work to proceed.

Following excavation and backfill but prior to site restoration, SVE/bioventing wells will be installed at each property where required. Additionally, for those properties where a sub-slab mitigation system is required, the system will be installed concurrent with or following the excavation activities.

8.1.5.3 Materials Handling

As soon as feasible, excavated soils will be loaded directly into an awaiting transport vehicle (i.e., end-dump truck, dump truck, or covered soil bin) using the excavator, front-end loader or skid-steer mini-loader. To the extent possible, impacted soil will be direct loaded into approved waste haulers for transport to the appropriate recycling or disposal facility. Care will be taken to ensure that all loose soil is brushed off the transporter and properly managed prior to covering with a tarp.

In the unlikely event that it is necessary to temporarily stockpile soil onsite before loading, soils either will be covered with plastic sheeting, or they will be temporarily placed in a covered bin.

Waste haulers will follow prescribed transportation routes that will be specified in a Transportation Plan that will be included in the RDIP. Haul trucks will not be permitted to stage within the Carousel community while waiting to be loaded and will not be permitted to idle for longer than five minutes during loading.

Excavated impacted soil will be transported offsite to appropriately licensed recycling/disposal facilities by a state-licensed waste hauler for appropriate recycling or disposal. Soils will be pre-profiled during the RDIP process, and approval will be obtained from the recycling/disposal facilities before excavation activities begin. A minimum of one sample per 500 cubic yards of export soil will be required by the recycling/disposal facility for profiling purposes. If possible, samples for profiling will be collected from geotechnical borings at appropriate depths. All documentation pertaining to waste disposal profiles and waste disposal acceptance will be in place prior to any offsite shipments of waste. If it is necessary to stockpile any soils while awaiting analytical results, soils will be appropriately covered and contained in accordance with SCAQMD 1166 requirements, and may be transported to a contractor storage yard.

8.1.5.4 Dust, Vapor and Odor Control

Dust suppression using water mist will be performed as required during excavation activities. Water mist will also provide the first level of vapor and odor control. Care will be taken to ensure that the soil is not over-saturated which could generate runoff that would need to be managed and increase the weight of soil to be disposed. The focus of this effort will be to assure that particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) levels to exceed 50 micrograms per cubic meter ($\mu g/m^3$). Excavation and loading operations will cease if the wind speed is greater than 15 miles per hour (mph) averaged over a 15-minute period or instantaneous wind speeds exceed 25 mph.

Based on monitoring data or odor perception, vapor and odor control will be implemented on an as needed basis. Based on experience from the excavation pilot test, Rusmar AC-565 Long Duration Foam was found to be most effective at controlling vapors and odors. This type of foam, or equivalent, and necessary support equipment will be staged and ready for application at locations where remedial excavations are conducted and there is the potential for odor releases.

8.1.6 Monitoring During Excavation Activities

A number of types of monitoring will be performed during Site remediation activities. These include:

- Worker health and safety in accordance with the Health and Safety Plan (HSP);
- Monitoring and reporting to comply with SCAQMD Rule 1166 Mitigation Plan requirements;
- Dust monitoring for SCAQMD Rule 403 Compliance;
- Meteorological monitoring of atmospheric conditions, including wind direction and speed using a portable meteorological station; and
- Monitoring for odors.

8.1.7 Post-Excavation Sampling

Post-excavation soil samples will be collected to document concentrations of certain COCs remaining on properties following excavation. This sampling will supplement the more than 10,000 soil samples that have previously been collected from residential properties.

Post-excavation soil samples will be collected from the walls of excavations adjacent to residential structures. Samples will only be collected from walls of excavations along property lines, where the adjacent property has not been or is not scheduled to be excavated. Samples will be collected from two depths at two locations along each side of the residences (8 locations, 16 samples total) and from two locations at the bottom of each excavation in the back and front yards (4 samples), yielding a total of 20 samples per property. Samples will be collected from two locations at two depths along property lines in the front and back yards of properties where the adjacent property will not be excavated. Depths of sidewall samples will be established in the field based on visual observations. These samples will be analyzed for COCs with the potential to migrate to soil vapor and groundwater, including TPHg, TPHd, TPHmo, and VOCs. Because of their very low solubility and migration potential, post-excavation samples will not be analyzed for SVOCs, PAHs, or metals.

8.1.8 Site Restoration

As described above, hardscape and landscaping will be removed during the initial stage of excavation and restored to like conditions following completion of excavation. If it is necessary to remove fences and block walls between yards and ornamental or partitioning walls on individual properties, these hardscape features will be restored to like conditions or as agreed to with the homeowner.

During homeowner meetings that will be part of the RDIP process, hardscape and landscape restoration will be discussed and agreed to with the owner. Alternative hardscape and landscaping will be considered if requested by the owner and it does not result in significant schedule or cost impacts.

Backfill will begin upon completion of excavation and installation of other remedial elements, described in Sections 8.2 and 8.4 below, are completed. Borings from auger excavation will be backfilled with 2-sack slurry the same day they are excavated. Where slot trenching is used for 5-foot excavations or for targeted deeper excavations to 10 feet, the lower part of the slot trenches will also be backfilled with 2-sack slurry. The upper 3 feet of excavations will be backfilled with certified clean imported soil. Backfill soil will be free of deleterious organic matter (i.e., vegetation) and cobbles larger than 4 inches in diameter, and be approved by the Geotechnical Engineer. Backfill soils will be moisture conditioned to near optimal moisture content and compacted to at least 90% relative compaction, or as determined by the Geotechnical Engineer and approved by LACDPW and the City of Carson in the Grading Permit. The upper foot of soil backfill will be topsoil suitable for vegetation growth and will be compacted to not more than 85% relative compaction. The Geotechnical Engineer or Contractor will perform compaction testing during fill placement and prepare a final grading compaction report for each property.

Hardscape will be restored soon after backfill is completed, after which the residents will be able to return to their homes while landscape restoration and reconstruction of fences and walls continues.

In addition to restoration at individual residences, Shell anticipates that it will be necessary to apply an asphalt top coat to City streets within the Carousel tract following completion of excavation of residential yards and installation of SVE wells and piping.

8.2 SOIL VAPOR EXTRACTION (SVE)/BIOVENTING

SVE and bioventing are the selected remedial technologies to address petroleum hydrocarbons, VOCs, and methane in soil vapor and to promote degradation of residual hydrocarbon concentrations that do not meet RAOs, or are not removed by excavation. Use of SVE/bioventing will address impacted areas beneath existing paved areas, City sidewalks, and concrete foundations of the homes, in addition to addressing reduction of COC concentrations in excavated areas below 5 feet bgs and areas not targeted for deeper excavation for mass removal with the goal of achieving SSCGs over time. Operation of the SVE/bioventing system will also address impacted soils that may be associated with residual concrete reservoir slabs left in place below the depth of excavation.

SVE is recognized as an effective technology for removal and treatment of VOCs from impacted soils. The process involves inducing airflow in the subsurface with an applied vacuum, enhancing in-situ volatilization of VOCs, and effecting movement of the VOCs to vapor extraction wells for removal from the subsurface. SVE is also effective at removing methane from subsurface soils and has been used for this application at other hydrocarbon-impacted sites and at landfills. SVE would effectively remediate the lighter volatile-range petroleum hydrocarbons, VOCs, and methane.

SVE pilot tests were conducted to evaluate the potential effectiveness of SVE to remove vapor-phase VOCs from subsurface soils at three onsite locations in areas with soil conditions ranging from likely favorable to potentially unfavorable for SVE. The SVE pilot test activities and results are provided in the S*oil Vapor Extraction Pilot Test Report* (URS, 2010f) and summarized in Section 4. The SVE well configuration at the Site will be based on the average effective ROVI from the pilot test results.

Bioventing is an in-situ technology generally applicable to the remediation of petroleum hydrocarbons in shallow soils. In this process, air is introduced into the subsurface to provide oxygen to enhance biodegradation of petroleum compounds. As summarized in Section 4.3.2 and in more detail in the final *Bioventing Pilot Test Summary Report* (Geosyntec, 2012b), bioventing was found to be effective at reducing hydrocarbon concentrations in Site soils over time. SVE working in concert with bioventing will promote microbial degradation of longer-chain petroleum hydrocarbons and, over the long term, reduce concentrations of these less-volatile compounds in the subsurface.

The SVE system will be operated in a cyclic manner, with active extraction in different portions of the Site at different times. The SVE/bioventing system(s) will be operated cyclically (pulsed) to extract impacted soil vapor and introduce oxygen to the subsurface to stimulate degradation of the heavier fraction of diesel-range hydrocarbons and motor oil-range hydrocarbons in a bioventing operational mode. During periods of active vapor extraction from a sub-set of wells ("on" cycle), the SVE system will not only remove hydrocarbon vapors, but will also draw oxygen into the subsurface to enhance the biodegradation of residual petroleum hydrocarbons in soil. During periods when no extraction is occurring for the set of wells ("off" cycle), remediation will be achieved through biodegradation alone (i.e., bioventing). The system will be designed to use the same infrastructure (i.e., extraction wells) for both SVE and bioventing, and the cyclic operating conditions will be used to implement both remedial actions. The SVE/bioventing system will be operated in manner to achieve the soil oxygen demand estimated from the bioventing pilot tests (Geosyntec, 2012b).

8.2.1 SVE/Bioventing Conceptual Design

SVE/bioventing will be implemented throughout the Site to remediate volatile petroleum hydrocarbons (i.e., gasoline-range petroleum hydrocarbons and the lighter fractions of the diesel range petroleum hydrocarbons), VOCs, and methane, and induce increased airflow to promote microbial degradation of longer-chain hydrocarbons (diesel and motor oil-range petroleum hydrocarbons). The SVE/bioventing infrastructure will consist of a system of extraction wells, belowground conveyance piping, aboveground manifold and treatment compound(s), vapor treatment system(s), and various system controls and instrumentation. SVE will be applied in the shallow zone from approximately 5 to 10 feet bgs, intermediate zone from approximately 15 to 25 feet bgs, and deep zone from approximately 30 to 40 feet bgs and locally deeper depending on depths of soil impact and depth to groundwater. Nested shallow, intermediate, and deep zone wells will be installed in the streets of the Site, which provide ready access for installation. Shallow zone wells will also be installed within the front and back yards of select residences. Locations of these shallow-zone wells in the front and back yards will be based on locations where RAOs are not met in the 0 to 10 foot bgs depth interval and to achieve SVE/bioventing coverage beneath houses. Well and piping components for SVE/bioventing wells installed on residential properties will be entirely below grade (see Figures 8-5 and 8-7). These shallow wells will be screened from 5 to 10 feet bgs

and will be connected to the SVE system via conveyance piping, which will be installed in the streets.

Based on the SVE pilot test ROVI results for the intermediate zone, a total of 63 nested well clusters (shallow, intermediate, and deep zone) will be installed in the streets with an average spacing of approximately 125 feet. Based on the estimated ROVI of 50 feet for the shallow zone from the SVE pilot test, an additional 65 shallow zone wells will be installed between the nested wells in the streets of the Site to provide increased vapor extraction coverage within the shallow zone. Additionally, shallow zone wells will be installed in the front and back yards of residences requiring remediation of the shallow zone soil by SVE/bioventing. Due to potential short-circuiting from surface landscaping, the shallow zone ROVI for the residential wells is estimated to be 25 feet. The ROVI for the SVE/bioventing system is based on the results of the SVE pilot test rather than the bioventing pilot test, because the blower planned for vapor extraction of the combined system is a robust unit with large capacity and vacuum and a system to treat extracted vapors (see Section 8.2.2). The estimated radius of influence reported for the bioventing pilot test (Geosyntec, 2012b) assumed small fans would be used to minimize the concentrations of extracted vapors. The radii of influence estimated from the bioventing pilot test are not applicable for the proposed SVE/bioventing system.

A total of 221 residences[11] are proposed for SVE/bioventing remediation. The estimated vapor extraction coverage for the shallow, intermediate, and deep zones is shown on Figures 8-1, 8-2, and 8-3, respectively.

Upon approval of the RAP, a RDIP providing the well field layout, SVE system(s) location(s) and specifications, and conveyance piping layout will be submitted for RWQCB approval.

8.2.2 SVE/Bioventing Equipment

Based on the estimated quantity of extraction wells (63 nested street wells, 65 shallow zone street wells, and 472 shallow zone residential wells), it is impractical to construct an SVE system to extract simultaneously from all of the proposed wells. As a result, a system or systems rated for a combined 3,000 standard cubic feet per minute (scfm) at up to 12 inches of mercury (in-Hg) vacuum is planned.

Shell is currently evaluating offsite locations for the installation of the remediation equipment, as well as the potential use of multiple smaller SVE systems to allow for more flexibility of vapor treatment. Potential offsite SVE system locations are being evaluated in terms of technological feasibility, accessibility and availability of the locations. These potential SVE locations are shown on Figure 8-8. The three offsite locations are on the former Turco Property (owned by Pedro First, Ltd., an affiliate of Black Equities Group, Ltd. and occupied by American Logistics International), the business park located at 24412 So. Main Street owned by 24412 So. Main Street, LLC and managed by Surf Properties, and vacant land north of the MTA/BNSF rail line owned by County

[11] Note: The table at the end of Section 6 indicates that 224 properties are identified for consideration for remedial planning. Of these, three properties are based only on excavation due to occurrence of metals, and these properties are not included in the 221 locations identified for SVE/bioventing remediation.

Sanitation District No. 8 and leased to CBB Carson Properties and managed by SB Management Corporation, part of Black Equities Group, Ltd. Shell is currently in discussions with representatives of these three locations regarding access for system installation. To minimize impacts on the residents and preserve the integrity of the neighborhood, construction of the treatment system at an offsite location is the preferred option, rather than within the neighborhood. If a suitable offsite location cannot be secured, Shell will consider options for locating the treatment system within the neighborhood. Based on preliminary discussions with the SCAQMD, it would be possible to permit a SVE treatment system in a residential neighborhood if risks associated with air emissions are below threshold levels.

The SVE/bioventing system(s) will be operated cyclically (pulsed) to extract impacted soil vapor and introduce oxygen to the subsurface to stimulate biodegradation. The SVE component of this remedial measure will remove gasoline-range hydrocarbons and the lighter fractions of the diesel-range hydrocarbons. The bioventing component will result in biodegradation of the heavier fractions of the diesel-range and motor oil-range hydrocarbons in a bioventing operational mode. Pulsing of the SVE/bioventing system will consist of extracting from select well sets for a pre-determined time interval. The time intervals and well sets will be determined based on data collected during start-up activities and may be modified based on monitoring data collected during the remedial action period.

As observed during the pilot test, granular activated carbon (GAC) effectively removed the lighter volatile-range petroleum hydrocarbons and VOC mass from the extracted soil vapor. However, with lighter volatile-range petroleum hydrocarbons representing the majority of the total contaminant mass removed and the expected concentrations, alternative treatment technologies such as thermal and/or catalytic oxidation are likely to be initially more effective. In addition, GAC will not remove methane from the recovered vapors, which will require an alternate treatment technology. The design of the SVE system potentially will include use of multiple treatment technologies in a staged approach, depending on inlet concentrations. The remediation equipment will provide the flexibility to transition from thermal oxidation to catalytic oxidation followed by GAC treatment, when the concentrations have decreased sufficiently.

Due to the localized presence of chlorinated compounds in soil vapor, thermal oxidation could generate acid gas as a by-product of the combustion process. The use of thermal or catalytic treatment would need to be evaluated in the RDIP prior to implementing this technology. However, methane is effectively treated using thermal technologies. A thorough evaluation of the use of thermal treatment and GAC will be performed and presented in the RDIP to establish the appropriate technology to treat the various contaminants detected at the Site. The off-gas treatment system will be permitted by SCAQMD. The permit application will be submitted to SCAQMD after the RDIP is approved by the Regional Board.

The SVE/bioventing treatment system(s) will be installed in an enclosed structure constructed with sound attenuation insulation to reduce operating noise levels to decibel (dB) levels at our below the City of Carson Noise Ordinance. The system will have an effluent discharge stack of sufficient height for dispersion of treated off gases, consistent with modeling results and requirements in the

SCAQMD permit to Construct/Operate. As described in Section 9, the detailed design of the SVE/bioventing system will be presented in the RDIP.

8.2.3 SVE/Bioventing Well Installation

The SVE/bioventing extraction wells in the streets will be constructed as either triple-nested vertical wells in the same borehole, separated by cement/bentonite seals similar to those used during the SVE pilot test, or single shallow zone wells. The triple-nested wells will have screen intervals of 5 to 10 feet bgs, 15 to 25 feet bgs, and 30 to 40 feet bgs for the shallow, intermediate, and deep zones, respectively. However, the actual screen length/depth intervals may be revised based on subsurface stratigraphy encountered during well installation. A minimum separation of 5 feet will be maintained between each screen interval. The single shallow zone wells will have screen intervals of 5 to 10 feet bgs. Each well will be completed within a flush-mount traffic-rated well vault surrounded by a concrete skirt. Typical nested and single shallow zone well construction details are shown of Figures 8-4 and 8-5, respectively.

Findings of the Revised HHRA regarding properties where concentrations of COCs would not meet RAOs were used to identify properties that will require SVE/bioventing. In total, 221 properties were identified for treatment with SVE/bioventing. The actual locations for installation of residential SVE/bioventing wells will be established during system design based on COC and methane distribution in the subsurface (as depicted on Figures 3-3 through 3-17). Shallow SVE/bioventing wells will be installed at individual residences, where required, and will be screened from approximately 5 to 10 feet bgs or to the depth of the former reservoir concrete slabs if present at less than 10 feet bgs. In general, two wells are planned at each property where RAOs are not met. The number of wells will be increased for larger properties, as appropriate, to achieve SVE/bioventing coverage beneath the building foundation slab based on the ROVI and lot configuration. At properties that have pools, the number of wells may be increased to achieve SVE/bioventing coverage beneath the residence.

The shallow wells will be constructed similar to the single shallow zone wells installed in the streets but will be completed entirely below ground and not visible from the surface. The SVE/bioventing wells and conveyance piping within the residences will be covered with backfill soil.

At residential properties where remedial soil excavation will be performed, wells will be installed following backfill placement either by hand or using a small Bobcat skid-steer or similar equipment with a power auger attachment. Conveyance piping will be laid prior to final backfill and grading, and will be brought to the back of sidewalks for later connection to piping in the streets. At residential properties that will not have excavation performed but that will have SVE/bioventing wells, well and piping installation will be done in the same general timeframe as nearby properties that are being excavated and SVE/bioventing wells and piping are installed. At non-excavated properties, the wells will be installed by hand and piping will be laid in hand excavated trenches. Hardscape and landscaping that is affected by well and/or piping installation will be restored to like conditions following installation. Plan view and cross-section schematic views of a typical residence soil excavation and SVE/bioventing well system installation details are shown on Figures 8-6 and 8-7, respectively.

8.2.3.1 Trenching

Conveyance piping will be installed in trenches within the City streets. Trenching will require the same monitoring and vapor and odor mitigation as residential excavations. Odors will be controlled using long-acting vapor suppressing foam, as necessary. Shell anticipates that it will be necessary to apply an asphalt top coat to City streets within the Carousel tract following completion of excavation of residential yards and installation of SVE/bioventing wells and piping.

8.2.4 SVE/Bioventing System Operation

The SVE/bioventing system will be operated until RAOs are met, by cyclical extraction from the well field in sets of wells. The extraction "well sets" to be operated concurrently will be determined during the two to three month startup phase of SVE/bioventing operation and adjusted and optimized periodically throughout the duration of SVE/bioventing operations at the Site. Cycling of the system will promote oxygenation of the subsurface which will enhance the biodegradation of residual petroleum hydrocarbons when the SVE is in the "off" cycle and will revert back to SVE mode when the area is switched to the "on" cycle. It is expected that recovered vapors from SVE system operation will decline through time and SVE operation can be discontinued in some wells and active operation shifted to other parts of the Site. In this case, the wells would still need to be operated periodically to introduce oxygen to the subsurface in a bioventing mode of operation.

Field activities associated with the system operation will include periodic Site visits to record operating parameters; monitor VOC and methane concentrations in the influent, effluent, and extraction wells using field instrumentation, and for performance of routine system preventive maintenance and troubleshooting. The recorded operating parameters, and influent, effluent, and well concentrations will be used to fine tune and adjust the system and to optimize influent VOC and methane concentrations to sustain removal rates to achieve remediation with the shortest possible time frame, and to maintain compliance with the SCAQMD permit. As part of the operations and maintenance (O&M) activities, it is expected that field personnel will periodically need to access well boxes in the streets. The frequency of accessing well boxes will be established during system startup. Field personnel will not need to access wells installed on residential properties for O&M purposes.

It is anticipated that the SVE/bioventing system(s) will be operated on a continuous basis and shut down only during performance of routine maintenance. The potential operating time for the SVE/bioventing system has been estimated based on data collected during the SVE and bioventing pilot tests (URS, 2010f; Geosyntec, 2012b). The operating time for the SVE/bioventing system is a function of soil concentrations, TPH composition, and operating parameters (e.g., percent operating time for an individual extraction well). In general, areas with lower TPH concentrations will achieve the RAOs more quickly than areas with higher soil concentrations. SVE will be more effective at removing the lower molecular weight (i.e., more volatile) constituents present in soil. The higher molecular weight constituents will be remediated through bioventing. Based on the TPH fractionation analyses conducted as part of the Phase II Site characterization, estimates for SVE/bioventing system operating time assume that the gasoline-range hydrocarbons and the lighter

fraction of the diesel-range hydrocarbons will be remediated by SVE and the heavier fraction of the diesel-range hydrocarbons and motor-oil range hydrocarbons will be remediated by bioventing.

- SVE: The average vapor extraction rate of the shallow wells in the SVE pilot test ranged from approximately 20 to more than 100 scfm. Assuming a ROVI of 50 feet, 10-foot treatment zone thickness, soil air-filled porosity of 0.3, and 10% operating cycle, a pore volume will be extracted every 30 days. In order to remove mass that may be in residual or sorbed phases in the vadose zone, it is assumed that 100 pore volumes of vapor extraction will be sufficient to meet the SVE remedial goals. The cyclic operation of the SVE/bioventing system will facilitate removal of mass-transport limited migration of constituents from residual or sorbed phases to the vapor phase. Based on these assumptions,, the estimated SVE operating time is approximately 5 years. However, areas with higher VOC concentrations may require longer SVE system operation than areas of average or lower concentrations. Note that the RAOs for protection of groundwater will be met by remediating the lower molecular weight TPH fractions which have a greater leaching potential (TPHCWG, 1997).
- Bioventing: The bioventing pilot test found that relatively low air flow rates (i.e., less than 1 scfm) are necessary to deliver sufficient oxygen to meet the bioventing oxygen demand. This oxygen demand will be met by implementation of the combined SVE/bioventing system described above. An estimate for the biodegradation rate for TPH in soil can be made using a stoichiometric evaluation for the amount of oxygen necessary to biodegrade residual hydrocarbons (ITRC, 2009). Based on the estimated flow rate of the SVE/bioventing system, sufficient oxygen to remediate soils with TPH concentrations of 10,000 mg/kg will be delivered to the subsurface within approximately 30 years. An alternate approach to estimate the operating time for the bioventing system is to calculate the time necessary for TPH concentrations following SVE operation to be reduced to SSCGs. Based on the distribution of TPH in soils and the remediation of gasoline-range hydrocarbons and the lighter fraction of the diesel-range hydrocarbons by SVE, soils with initial TPH concentrations of 10,000 mg/kg will likely be reduced to approximately 7,500 mg/kg (TPHd = 2,500 mg/kg and TPHmo = 5,000 mg/kg). A 40 percent reduction in these concentrations is necessary to meet the risk-based SSCGs. Following methods presented in the bioventing pilot test summary report (Geosyntec, 2012b), a time period of 30 to 40 years of bioventing operation is estimated to achieve these remedial action objectives.

These operating periods should be considered preliminary. Operation of the SVE/bioventing system will be optimized during the remedial action as monitoring data are collected (e.g., increase cycle time for areas with higher concentrations). Improved estimates of the potential operating time for the SVE/bioventing system can be made after analysis of these monitoring data.

8.3 SUB-SLAB VAPOR MITIGATION

Based upon the multiple lines of evidence evaluations presented in the Follow-up Indoor Air Reports and Final Interim Reports, Geosyntec and URS have concluded that constituents detected in indoor air are reflective of background sources. Notwithstanding the fact that regulatory guidance does not

require remediation of COCs present at or below background levels, the RWQCB directed Shell to evaluate theoretical exposures due to the vapor intrusion pathway using the detected concentrations of COCs in sub-slab soil vapor. The Revised HHRA includes this vapor intrusion evaluation and theoretical exposures were calculated using conservative assumptions (e.g., sub-slab soil vapor to indoor air attenuation factor of 0.002). Consequently, sub-slab vapor mitigation systems will be installed at residential properties where RAOs for soil vapor would not be met based on potential exposure due to vapor intrusion of petroleum hydrocarbons or chlorinated ethenes (e.g. PCE and TCE) from soil vapor to indoor air, and at the two locations where detected methane concentrations in sub-slab soil vapor probe samples exceed the methane SSCG of 0.5%. One of these properties has already had an interim mitigation system installed, and the other only slightly exceeds the methane SSCG of 0.5% methane in a single measurement from a single sub-slab probe. Note that potential exposures to trihalomethanes (i.e., chloroform, bromodichloromethane, or dibromochloromethane) were not considered in this assessment, because the presence of these constituents in soil vapor is believed to be due to off-gassing from municipal water (either leaking water lines or sewer lines or applied irrigation).

Based on the HHRA results and methane detected in sub-slab soil vapor, 28 properties have been identified for sub-slab vapor mitigation as summarized in Table 6-1 and shown on Figure 6-4. Twenty-seven (27) properties were identified based on RAO exceedance for potential vapor intrusion, and one property was identified based on methane. In addition, while the data do not indicate that vapor intrusion is an issue at any of the residences, Shell is prepared to offer installation of a sub-slab mitigation system to any of the homeowners in the Carousel neighborhood to alleviate concerns about potential impacts to their indoor air from the Site.

Sub-slab depressurization (SSD) systems will be used to mitigate the potential vapor intrusion pathway at the Site. The SSD system creates a negative pressure below the slab of the residence using a fan to remove air from below the slab and exhausting it above the building. This process keeps vapors emanating from the soil below from entering the building.

SSD design, installation, and operation will be in general accordance with the DTSC Vapor Intrusion Mitigation Advisory (DTSC, 2011). The system consists of creating holes in the slab or footing, removing a quantity of soil from beneath the slab to create suction pit and placing suction pipes into the holes. The suction pipes are directed to above the roof and a fan connected to the system to create a sub-slab vacuum.

8.3.1 Diagnostic testing

After installation of the SSD system, diagnostic testing will be conducted to assess the vacuum distribution beneath the building foundation and whether modifications to the system design (e.g., larger fan or additional suction pits) is warranted. The PVC riser pipe joints will not be glued until the initial system diagnostic tests are complete. The diagnostic testing consists of the following activities:

- A fan will be temporarily installed on the vent pipe from the suction point(s).

- Quarter-inch diameter hole(s) will be drilled through the floor of the residence and slightly into the sub-slab soils across the slab away from the suction point(s). These test holes will be used to monitor the differential air pressures across the slab (above and below the slab). The floor will be repaired and restored following the diagnostic testing.
- Initial pressure differentials will be recorded with the fan off. The fan will then be turned on (exhausting the gases outside the home) and the static vacuum in the riser pipe(s) and differential pressure at the test hole(s) measured using a digital micro-manometer, with a resolution of 0.0001 inches of water column (in-WC) and an accuracy of ± 1% of the reading or ±0.0005 in-WC.
- Airflow will also be measured with one of the following instruments: a vane anemometer, a hot wire anemometer, or a pitot tube. If measured airflow and vacuum are not within the fan's performance specifications, an alternate fan will be selected.

The SSD system will be considered effective once vacuum conditions are established beneath the slab. Because indoor air concentrations measured during the Phase II investigation are indistinguishable from background levels, effectiveness of the SSD will be assessed only through cross-slab differential pressure measurements. Additional indoor air/sub-slab soil vapor sampling is not necessary to further assess the vapor intrusion pathway following installation of the sub-slab vapor mitigation system; however, as discussed in Section 8.6, additional sub-slab soil vapor monitoring will be performed in accordance with Regional Board directives.

8.3.2 Permitting

Because the SSDs will operate in an active and not a passive mode, SCAQMD will require permits for the active operation of the SSD systems. After completion of the diagnostic testing, a permit application will be submitted to SCAQMD. Additionally, Shell contractors will confirm that homes with a SSD have a carbon monoxide (CO) monitor, as required in all homes by California law.

8.4 GROUNDWATER

8.4.1 Description of Groundwater Occurrence, Quality and Potential Sources

Groundwater beneath the Site has been extensively investigated and reported to the RWQCB since initial well installation in 2009. A description of groundwater conditions including occurrence, quality, COCs, and COC sources was presented in the Revised SSCG Report (Geosyntec, 2013c) and is summarized in Section 3.3.4 above. The SSCGs for groundwater at the Site are listed in Table 5-3 of this RAP document.

8.4.2 Groundwater Remediation Plan

8.4.2.1 Site-Related COCs

Reduction of Site-related petroleum COCs in groundwater (benzene, naphthalene, TPH) to meet RAOs will eventually occur due to natural processes, but will be accelerated by the significant accompanying source reduction proposed in Section 8.1, 8.2 and 8.5 of this RAP. Reduction of TPH-related compounds to the SSCGs is expected to cause arsenic to decrease to background levels

as aerobic conditions return (Section 3.3.4.5). Without source reduction in the vadose zone or of LNAPL, the length of time needed to meet RAOs in groundwater is expected to be long (several hundred years). However, following the significant source zone reduction proposed in the RAP for soils, soil vapor, and LNAPL, reduction of Site-related COCs to meet RAOs is expected to require much less time. For example, based on modeling, benzene levels in groundwater will likely meet SSCGs at the Site in approximately 70 years (see discussion below) assuming significant vadose zone and LNAPL source zone reduction onsite, as well as source reduction associated with identified upgradient sources (RWQCB, 2014a).

It is proposed that source reduction through excavation, SVE/bioventing in the vadose zone, as well as LNAPL removal as discussed below, will be used in conjunction with MNA as the remedy for Site-related COCs in groundwater. MNA relies on naturally occurring processes to decrease concentrations of chemical constituents in soil and groundwater. Natural processes include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of constituents in media of concern.

MNA is listed as a common remedial approach used for leaking underground fuel tank (LUFT) sites (SWRCB, 2012). According to the USEPA, Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-17P (USEPA, 1999), "*the most important considerations regarding the suitability of MNA as a remedy include: whether the contaminants are likely to be effectively addressed by natural attenuation processes, the stability of the groundwater contaminant plume and its potential for migration, and the potential for unacceptable risks to human health or environmental resources by the contamination. MNA should not be used where such an approach would result in either plume migration or impacts to environmental resources that would be unacceptable to the overseeing regulatory authority.* ***Therefore, sites where the contaminant plumes are no longer increasing in extent, or are shrinking, would be the most appropriate candidates for MNA remedies."*** Consistent with the USEPA Directive 9200.4-17P, the LUFT Manual (SWRCB, 2012) indicates that the first line of evidence for natural attenuation is the use of trend analyses on historical data to demonstrate that the plume is stable or retreating.

Trend analyses and modeling were conducted in the *Revised Site-Specific Cleanup Goals Report* (Geosyntec, 2013c) to assess temporal trends and the stability of the benzene plume at the Site to support the MNA approach. Results of the Monitoring and Remediation Optimization System (MAROS) analysis indicated that the benzene in Site groundwater is likely being attenuated through natural biodegradation processes and is a stable or decreasing plume. This conclusion is supported by the current observed distribution of benzene in the plume, which shows significant attenuation (to non-detect or near non-detect concentrations) at the downgradient plume edge near the property boundary). The conclusion is also supported by the significant age of the plume source (more than ~50 years). In addition, the Bioscreen model simulation results (Geosyntec, 2013c) show that even without source zone reduction no significant down-gradient migration of the benzene plume is predicted. The second simulation, which assumed 80% benzene source zone mass removal (a reasonable assumption given the proposed remedy of LNAPL removal coupled with SVE that will remove a large proportion of the leachable lighter petroleum fractions including benzene, and soil

excavation), predicts that the benzene concentrations in groundwater will be degraded to below the MCL in approximately 70 years, also with no significant down-gradient migration of the benzene plume. This of course assumes that the overseeing agencies will be successful in stopping off-Site migration of COCs onto the Site.

In summary, MNA is an appropriate remedy for Site-related COCs in groundwater because:

- The benzene plume at the Site is limited in areal extent and is stable or declining due to natural degradation processes.
- Benzene and TPH are well-defined and generally limited to the Site (i.e., they do not extend significantly downgradient of the Site boundary nor into the underlying Gage aquifer with the exception of the migration of benzene presumably from the adjacent Turco site which has impacted the Gage aquifer beneath the northwest portion of the Site). Benzene is collocated with TBA indicative of a gasoline release (not crude oil) in that location.
- The Shallow groundwater at the Site will not be used in the foreseeable future due to: (1) high total dissolved solids and other water quality issues unrelated to Site conditions, (2) is present in a low yield, thin aquifer, (3) there are restrictions on groundwater pumping in the basin due to the adjudication of the groundwater resource; and, (4) the overlying land use is completely residential without the needed open space for water production infrastructure.
- Significant reduction of Site-related COCs in the vadose zone source areas is anticipated with any proposed Site remedy.

The post-remediation natural reduction in Site-related COC concentrations in groundwater will be monitored. Semi-annual monitoring of both shallow zone and Gage wells will be conducted for a five-year period following implementation of SVE/bioventing. Groundwater samples will be analyzed for the COCs, including select MNA parameters[12]. The semi-annual MNA program will commence during implementation of the RAP, specifically following the startup phase of the SVE system. If after five years of semi-annual MNA monitoring the concentrations of Site-related COCs are not stable or decreasing based on statistical analysis, contingency in-situ groundwater remediation through oxidant injection will be considered at localized areas (i.e., where Site-related COCs exceed 100x MCLs) as discussed below. However, if the concentrations of Site-related COCs are stable or decreasing, the MNA program will continue and will be re-assessed after five additional years of annual groundwater monitoring.

It is also proposed that the RWQCB or other appropriate agencies actively pursue upgradient responsible parties who may be contributing to certain COCs (notably benzene, TBA, and chlorinated compounds and their breakdown products) migrating onto the former Kast Site. Additional discussion of these upgradient sources is also discussed in the Revised SSCG Report

[12] MNA parameters may include oxidation-reduction potential, dissolved oxygen, pH, nitrate, iron, sulfate, and methane.

(Geosyntec, 2013c). The potential or actual migration of these COCs onto the former Kast Site was indicated by the RWQCB (2014a).

8.4.2.2 Contingency Plan for Groundwater Remediation

If warranted by the results of the statistical analyses conducted on the initial five years of semi-annual MNA data, contingency remediation of certain Site-related COCs in localized areas of groundwater (e.g. where Site-related COCs exceed 100x MCLs) may be implemented. The purpose of this contingency remediation would be to further shorten the time over which the concentrations of COCs will return to background or MCL levels if the proposed Site remedy, including natural processes, is insufficient.

Oxidant injection was retained in the Revised FS report as the selected contingency in-situ groundwater remediation technology because it is more easily implementable and potentially effective, and results in less disruption to Site residents. Air sparging with SVE and biosparging were not retained for future consideration in the FS report due to the infrastructure requirements and potential for significant disruption to residents.

Injection of an oxidant (e.g., Oxygen Release Compound® [ORC®]) involves the introduction of an oxidant, in this case a phosphate-intercalated magnesium peroxide that, when hydrated, produces a controlled and continuous release of oxygen to the saturated zone. The controlled-release of oxygen to the saturated zone accelerates the development of existing indigenous microorganisms to biodegrade the organic constituents. This process involves mixing an oxidant with water to form a slurry that is pressure injected (using a pump) into the saturated zone. Once the slurry is injected into the groundwater, tiny oxidant particles produce a controlled-release of oxygen. Oxidant can also be injected into filter socks placed in wells. When filter socks are exhausted, spent socks are replaced with new filter socks containing the slurry to restore oxygen supply to promote biodegradation of remaining organic constituents. Similar commercially-available oxidants could also be used. Injection of chemical oxidants into the saturated zone would be conducted in accordance with applicable waste discharge requirements (WDRs).

Oxidant (e.g. ORC®) injection could be implemented in localized Site areas to remediate volatile petroleum hydrocarbons and VOCs. The conceptual evaluation assumes use of ORC® as the oxidant, although similar commercially-available oxidants could also be used. The oxidant injection program would consist of a system of injection wells where oxidant is delivered at the wellhead by pressure injection or by placement of filter socks containing oxidant. The oxidant would be injected/replaced on a periodic basis as evaluated in the pilot test report. Alternatively, the oxidant could be injected in one or more rounds without wells using direct-push or other technology.

The ROI for oxidant injection is estimated to be 15 feet. The conceptual design would target injection near wells with the highest concentrations of COCs in shallow groundwater, with the injection points transecting shallow groundwater water flow. The oxidant injectate volume and injection schedule would be optimized during operation as the rate of constituent removal would decrease when concentrations of dissolved constituents are reduced.

A pilot test would be performed to assess the ability of oxidant injection to achieve SSCGs. For conceptual design purposes, based on an estimated injection ROI of 15 feet at the Site, it is envisioned that a total of 19 oxidant injection wells or injection points would be installed in the streets with an average spacing of 30 feet (see Figure 8-9). If deemed necessary, and if this technology is selected for groundwater remedy, a RDIP providing the injection well location(s), specifications, and calculations of oxidant delivery will be submitted for RWQCB approval.

8.5 LIGHT NON-AQUEOUS PHASE LIQUIDS (LNAPL)

Shell will continue periodic LNAPL recovery where LNAPL has accumulated in monitoring wells (MW-3 and MW-12) to the extent technologically and economically feasible, and where a significant reduction in risk to groundwater will result. If LNAPL accumulates in the future in other wells to a measurable thickness, LNAPL recovery will commence from those wells, and if LNAPL accumulates at a thickness of greater than 0.5 foot in other wells, LNAPL will also be periodically recovered from those wells using a dedicated pump. The goal for LNAPL recovery will be an end point of no measurable LNAPL accumulation in monitoring wells at the Site.

LNAPL is currently being recovered from monitoring wells MW-3 and MW-12 on a monthly basis using dedicated pneumatic total fluids pumps installed in the wells. Recovered LNAPL is placed in drums which are immediately transported offsite for proper disposal. Periodic LNAPL recovery from MW-3 began on November 9, 2010, and recovery from MW-12 began on October 28, 2013. An estimated 108.9 and 10.6 gallons of LNAPL have been removed from MW-3 and MW-12, respectively, since LNAPL recovery began.

As part of the remedial actions described in this RAP, LNAPL recovery will continue from wells MW-3 and MW-12 on a monthly basis, and, if LNAPL is detected at a measurable thickness in other wells in the future, monthly LNAPL recovery will be initiated on these wells with sorbent socks or, if they have an LNAPL thickness of greater than 0.5 foot, with a dedicated pump. Monitoring of LNAPL and water levels, and LNAPL recovery volume monitoring will continue during LNAPL recovery events. When LNAPL recovery shows a declining trend in wells in which LNAPL occurs, recovery trends will be evaluated, a recommendation may be made to the RWQCB to reduce the frequency of LNAPL recovery, as appropriate.

In the future, Shell proposes to assess the economic and technical feasibility of continued hydraulic recovery of mobile LNAPL using LNAPL transmissivity (Tn) as a criterion. The Interstate Technology & Regulatory Council (ITRC) suggests that hydraulic recovery systems can practically recover LNAPL where the Tn is greater than 0.1 to 0.8 ft^2/day and that "Further lowering of Tn is difficult and can be inefficient; that is, it can take very long to marginally reduce Tn without much benefit in terms of reduction of LNAPL mass, migration potential, risk, or longevity" (ITRC, 2009). Tn will be assessed using baildown tests in wells with a minimum of 0.5 foot of LNAPL, as described by ASTM E2856-13 (ASTM, 2013). Evaluation of Tn may be used as an alternative end point for LNAPL recovery.

8.6 POST-CONSTRUCTION LONG-TERM MONITORING AND SAMPLING

This section provides Shell's recommended long-term monitoring and sampling plan for the Site. Post-excavation sampling from remedial excavations was addressed in Section 8.1.7.

8.6.1 Sampling of Existing Soil Vapor Probes in Streets and Utility Vaults

- Quarterly monitoring of existing soil vapor probes at 1, 1.5 and 5 feet bgs at nine onsite probe locations and one offsite location in the streets will continue until site conditions demonstrate it is no longer necessary or feasible.
- Quarterly monitoring of 69 onsite and offsite utility vaults will continue until after the SVE/bioventing system becomes operational and site conditions demonstrate it is no longer necessary.

8.6.2 SVE/Bioventing System Operational Sampling

- After installation and startup of the SVE/bioventing system, periodic monitoring will be conducted as specified in the SCAQMD Permit. Periodic monitoring will include, at a minimum, collection of system influent and effluent vapor samples for laboratory analyses for VOCs and fixed gases, as required in the SCAQMD permit.
- Results of the analyses, in conjunction with measured flow rates, field readings and time of operation, will be used to estimate the mass of VOCs removed from the subsurface, degradation of longer-chain hydrocarbons, and as a basis for optimizing and eventual shutdown of SVE operations and switching from the SVE/bioventing to bioventing mode of operations.
- Mass removal estimates will be provided to the RWQCB on an annual basis. The RWQCB will also be copied on reports required in the SCAQMD permit.
- System operational VOC and methane monitoring data, in conjunction with system effectiveness data (see below) will be evaluated to establish when soil vapor SSCGs have been met or asymptotic concentrations have been achieved. At that time, a recommendation may be made to terminate the SVE operational mode, in which case the system operational status would change to bioventing only mode and the extraction system would only be operated periodically to induce oxygen flow to the subsurface.

8.6.3 Monitoring of SVE/Bioventing System Effectiveness

- To monitor SVE/bioventing effectiveness, soil vapor and soil samples will be collected at 16 representative locations throughout the Site prior to start of SVE/bioventing system operation to establish baseline conditions.
    - The nested or clustered soil vapor well and probe locations and soil boring locations will be specified in the RDIP. The vapor well and boring locations will be situated in between the SVE/bioventing wells so that results are not strongly influenced by close proximity to the extraction wells.

  - Some of the soil vapor wells/probes will be installed near existing street soil vapor probes that are sampled quarterly, as these probes will likely be decommissioned during trenching in the street for SVE conveyance pipe installation.
  - Multi-depth soil vapor probes/wells will be installed at each location at depths of 1.5, 5, 7.5, 20 and 35 feet bgs. The 7.5, 20 and 35-foot sampling screen depths will target the midpoint of the SVE well screens.
  - Sub-slab soil vapor samples will be submitted to a state or National Environmental Laboratory Accreditation Program (NELAP)-certified laboratory and analyzed for VOCs by USEPA Method TO-15 and fixed gases (including methane) by ASTM Method D-1946.
  - To reduce homeowner disruption, additional soil vapor monitoring probes/wells will not be installed on residential properties.

- Following SVE/bioventing system startup, soil vapor samples will be collected from the 16 multi-depth SVE wells and soil vapor probes installed in the streets annually for 5 years and once every 5 years thereafter during system operation to monitor system effectiveness at reducing COC concentrations and degradation of longer-chain hydrocarbons.
- Results of the baseline and periodic sampling will be used to evaluate overall system effectiveness as well as optimize system operation and will be reported in an initial 5-year review report and subsequent reports submitted on a 5-year basis.
- Soil vapor samples will be screened in the field with portable field instruments and analyzed for VOCs by EPA Method TO-15 and fixed gases (including methane) by ASTM Method D-1946.
- Periodic measurements of vacuum at these SVE wells and soil vapor probes will be performed to evaluate and confirm the radius of influence of the system. If the design radius of influence is not confirmed by these vacuum readings, system operating parameters may be adjusted or need for installation of additional wells will be evaluated.
- Soil samples will be collected from 16 soil boring locations in the streets at representative locations throughout the site using a Geoprobe rig. Boring locations will be specified in the RDIP.
- Samples will be collected at depths of 7.5, 20 and 35 feet bgs (midpoint of SVE well screen intervals).
- After 5 years of SVE/bioventing system operation and at 5-year intervals thereafter, Geoprobe borings will be advanced and sampled at the same depths at locations adjacent to the previous borings and samples will be collected for comparative analysis with prior samples from the same locations.
- Soil samples will be analyzed for TPHg, TPHd, and TPHmo by EPA Method 8015M, and VOCs by EPA Method 5035/8260B. Samples will also be extracted using the Synthetic Precipitation Leaching Procedure (SPLP) to evaluate leachability of COCs in soil and reductions in leachability over time.

8.6.4 Residential Sampling

8.6.4.1 Sub-Slab Soil Vapor Probe Monitoring

- At the 202 properties identified for soil excavation from 0 to 5 feet bgs, sub-slab soil vapor probes will be monitored and sampled every other year for VOCs and fixed gases until remedial excavation is completed and the SVE/bioventing system becomes operational.
    - After the SVE/bioventing system is fully operational, sub-slab soil vapor probes will be monitored and sampled every 5 years at the same 202 properties until site conditions demonstrate it is no longer necessary.
    - Methane screening will be conducted using hand-held instruments inside the homes at the time of the sub-slab soil vapor probe sampling.
    - Soil vapor samples will be screened in the field with portable field instruments and analyzed for VOCs by EPA Method TO-15 and fixed gases (including methane) by ASTM Method D-1946.
    - Because outside sub-slab soil vapor probes in front and back yards will be removed along with residential hardscape, replacement probes will be installed in the garage (if one does not exist) so that two probes can be sampled per property.
    - If results of sub-slab soil vapor analysis indicate that potential vapor intrusion risk exceeds 1×10^{-6} and RAOs for potential vapor intrusion are exceeded, and the property has not previously been identified for installation of sub-slab mitigation, a sub-slab depressurization system will be installed.
    - If a sub-slab depressurization system has previously been installed, it will be checked to confirm it is working as designed, and if not, corrective steps such as installing a larger fan or expanding the system will be evaluated.
    - To minimize impact on residents, further indoor air sampling will not be conducted unless specific conditions indicate it is warranted. Rather, Shell recommends moving to mitigation rather than further characterization and accompanying disruption.
    - Also to minimize impact on the community sub-slab sampling will be conducted over a 6 to 8-week period each year and scheduled to accommodate homeowners to the extent possible.

8.6.4.2 Sub-Slab Depressurization (SSD) Systems

- The SSD monitoring program will consist of sub-slab soil vapor probe sampling at the properties where SSD systems are installed as follows:
    - One sampling event per year for years 1 through 5 following system installation;
    - One sampling event every other year for years 5 through 15; and
    - One sampling event every five years for years 15 through 30, or until site conditions demonstrate it is no longer necessary.

- Each sampling event would consist of checking sub-slab soil vapor probes for pressure/ vacuum, and sampling two or three sub-slab soil vapor probes, depending on timing relative to hardscape removal and garage probe installation, for analysis for VOCs and fixed gases (including methane).
- The SSD system will include a manometer or in-line pressure gauge to provide a simple measure that the system is operating as designed. Clear instructions (including the name and contact information for the appropriate Shell contractor) will be placed in a visible location to address problems with the SSD system operation.
- Annual inspections will be done to verify that the SSD systems are operating as designed and vacuum and flow rate of the SSD fan will be monitored.

8.6.5 Groundwater Sampling

- Following RAP approval, monitoring of both shallow zone and Gage wells will be conducted semi-annually.
- Groundwater samples will be analyzed for VOCs, TPHg, TPHd, TPHmo and metals, as well as select MNA parameters, including oxidation-reduction potential, dissolved oxygen, pH, nitrate, iron, sulfate, and methane.
- The semi-annual MNA evaluation program will commence following the startup phase of the SVE system.
- If after five years of semi-annual MNA monitoring the concentrations of Site-related COCs exhibit an increasing trend based on statistical analysis, contingency in-situ groundwater remediation will be considered at localized areas (i.e., where Site-related COCs exceed 100x MCLs).
- If concentrations of Site-related COCs are stable or decreasing, the MNA program will continue and will be re-assessed after five additional years of annual groundwater monitoring.

8.7 Construction Phase and Post-Construction Phase Activities

During the period of active remedial construction activities for soil excavation, backfill and property restoration, SVE/bioventing well and piping system installation, and installation of sub-slab mitigation, Shell's contractors will have a daily presence in the neighborhood. These activities will include use of excavators, backhoes and loaders, waste-hauling trucks and dump trucks to deliver fill soils, drilling rigs, personal trucks and other vehicles, and various supporting equipment. During the period of active remedy implementation, there will be periods of heavy truck traffic and construction activity.

Following the period of active remedial construction during which soil excavation and SVE/bioventing system installation will be completed, Shell's contractors will have a less visible presence in the community; however, continued periodic sampling will be performed at residences, streets, and for monitoring and O&M of the SVE/bioventing system.

9.0 PLANNED REMEDIAL DESIGN AND IMPLEMENTATION PLAN (RDIP) PROCESS

9.1 OVERALL RDIP PROCESS

Following approval of the RAP, a Site-wide Remedial Design and Implementation Plan (RDIP) will be prepared. The Site-wide RDIP will provide details on the design and implementation of the planned remedy outlined in this RAP. The RDIP is expected to include the following elements:

- Details of the non-property specific remedial excavation activities to be conducted on a Site-wide basis including elements of the remedial design, such as general excavation methodologies, permitting, and health and safety requirements.
- SVE/bioventing system design including well, treatment system compound location, piping and treatment system layout, as well as operation, monitoring, and maintenance plans.
- SVE/bioventing performance evaluation borings and multi-depth soil vapor probe designs.
- Sub-slab mitigation system design including operation, monitoring and maintenance plans.

Following approval of the RDIP, Property-Specific Remediation Plans (PSRPs) will be prepared for all properties that require excavation, sub-slab mitigation, and/or SVE/bioventing. The PSRPs will define areas to be excavated and depths of excavation, features to be removed and those that will be protected in place, and locations of underground utilities that need to be either protected in place or removed and restored, and will fulfill the requirements for municipal permitting. For those properties where sub-slab mitigation will be installed, the PSRPs will include details of the mitigation system design. The PSRPs will identify SVE/bioventing well and piping locations for the 221 properties where SVE/bioventing wells will be installed. The PSRPs will be prepared in groups according to the planned excavation phasing, to provide the level of detail needed for individual property permitting and restoration. It is anticipated that these groups of PSRPs will be submitted to the Regional Board for a two-week review period prior to submittal of permit packages to the municipal Building Officials.

Additional information on the Site-wide RDIP and the PSRPs is provided below.

9.2 SITE-WIDE RDIP

Preparation of the Site-wide RDIP will begin following conceptual approval of the RAP. The RDIP will provide a detailed discussion of the specific tasks necessary to implement the Site-wide remedy, including engineering design of the selected remedial actions, project phasing, and operation/ monitoring/maintenance of different components of the remedy.

The overall sequencing and preliminary schedule will be discussed, including activities necessary to fully implement each of the components of the remedy, how these activities will be coordinated to facilitate construction/implementation, and identification of potential major scheduling problems or delays which may impact the overall schedule.

Excavation equipment and methodologies to be included in the RDIP will apply to the property-by-property excavation activities (to be detailed in the PSRPs) and to the SVE/bioventing piping system installation. The Site-wide RDIP will address non-property specific elements of the remedial design, including general excavation methodologies, identification of suitable backfill criteria, surveying, traffic plans, notifications and site preparation, proposed odor, dust, and noise control measures, etc. It will additionally provide discussion of staging and logistical issues related to the excavation portion of the work.

For the SVE/bioventing system, the RDIP will include the proposed well field layout, SVE system(s) location(s) and specifications, and conveyance piping layout. This will include treatment system design criteria. The RDIP will detail the periodic monitoring, maintenance requirements, and reporting for SVE system operation. SVE/bioventing system recordkeeping requirements, including operating parameters; monitoring of the influent, effluent, and extraction wells using field instrumentation; and the performance of routine system preventive maintenance and troubleshooting will also be addressed in the RDIP.

The general sub-slab mitigation design will be included in the RDIP. Specific elements of the sub-slab mitigation system for each of the properties will be included in the property-specific design and permitting package presented in the PSRPs (see Section 9.3).

The RDIP will also identify anticipated permitting requirements and regulatory compliance activities, including Grading Permits, Stormwater Discharge Permits, dust control requirements, SCAQMD Rule 1166 Mitigation Plan requirements for excavation, SCAQMD Permit to Construct/Operate for SVE/bioventing operation, SCAQMD permits for asbestos removal to install the sub-slab mitigation systems and permits for treatment of sub-slab mitigation effluent, etc.

Following implementation of the remedy, operations, monitoring, and maintenance activities will continue at the Site, and these planned activities will be detailed in the RDIP. This will include operations, monitoring, and maintenance of active systems, as well as continued groundwater monitoring and LNAPL removal, and periodic monitoring of soil vapor probes and sub-slab soil vapor probes. The RDIP will provide additional details regarding selected locations for baseline and periodic sampling of soil and soil vapor to assess the effectiveness of the SVE/bioventing system on reducing concentrations of COCs. Additionally, a Five-Year Review Report is anticipated to be completed following five years of full-scale SVE/bioventing system operations and at five-year intervals thereafter. The specific purpose is to review site conditions and monitoring data, evaluate remedy effectiveness and recommend changes in remedy components, if warranted.

9.3 PROPERTY-SPECIFIC REMEDIATION PLANS (PSRPS)

As part of the RDIP, an individual remediation plan will be prepared for each property. The PSRPs will define areas to be excavated, features to be removed and those that will be protected in place, and locations of underground utilities that need to be either protected in place or removed and restored. The PSRPs will also include landscape restoration plans that will be developed in consultation with the property owners/residents.

A geotechnical evaluation will be conducted and grading plans prepared as part of each RDIP. For properties planned for targeted deeper excavation to 5 to 10 feet bgs, the geotechnical evaluation will include drilling and sampling of a soil boring to collect samples for soil index and strength properties (see Section 8.1.3.1). A geotechnical evaluation will also be prepared for properties planned for excavation to 5 feet bgs; however, these evaluations will rely on existing hand-auger boring data and data from geotechnical borings advanced at locations for targeted deeper excavation and will not have geotechnical borings conducted. Based upon these geotechnical evaluations, the PSRPs will include planned excavation slopes and/or setbacks from existing structures or other features, such as around building foundations, and sensitive utilities such as water mains present in front yards and power poles present in back yards, as required by the Geotechnical Engineer and in accordance with City, County, and utility provider requirements. For properties that will include SVE/bioventing activities, the PSRP will identify extraction well locations and sub-grade piping layout. For the properties that have been identified for sub-slab mitigation, an individual design package will be developed for each property and included in the PSRP. It is anticipated that, for properties where excavation will also be conducted, the sub-slab mitigation system will be installed concurrent with or soon after completion of excavation activities on that property.

Shell personnel will meet with homeowners/residents and their legal representatives as appropriate, during the PSRP preparation process to obtain necessary information for relocation during remedial implementation and to discuss hardscape and landscape restoration. During this meeting, existing landscape irrigation systems will be documented so that they can be restored as part of landscape restoration. In some cases, Shell may provide alternative landscape restoration from existing conditions if desired by the homeowner. If during this meeting the homeowners express a desire that existing hardscape or favored landscaping such as mature trees or shrubs not be removed from their property, an option will be discussed of leaving hardscape and landscaping in place with the homeowners agreeing to enter into a Land Use Covenant (deed restriction) that would be recorded with the County Recorder's Office advising of the potential presence of impacted soil beneath hardscaped areas.

9.3.1 Permitting

The remedial implementation work will require a number of permits from different agencies before the work can proceed. Subject to RWQCB approval of the RAP, Shell will begin securing necessary permits as part of the RDIP process and as PSRPs are completed. Permits will be required from the City of Carson, Los Angeles County, SCAQMD, and possibly other agencies. A discussion of major permitting activities is included below.

9.3.1.1 City of Carson Permits

Because the volume of soils to be excavated at individual properties is expected to be greater than 50 cubic yards (cy), Grading Permits will be required for each property where excavation is conducted. Grading Permits will be obtained from the City of Carson Department of Building and Safety (DBS). The City of Carson follows the LACDPW Grading Guidelines and is a contract city, meaning that the LACDPW provides plan check and approval services for the City. Based on these guidelines, a geotechnical soils engineering report and grading plans will be prepared for each affected parcel after

access has been obtained. As noted previously, geotechnical investigations for targeted deeper investigations will require a geotechnical boring to be drilled and sampled so that soils can be tested for index classification and soil strength testing. For the 5-foot excavations, to the extent feasible, existing Site soil boring data will be used to prepare geotechnical reports that are required as part of the Grading Permit submittal.

Early in the RDIP phase following submittal of the RAP, URS will meet with the City of Carson Building Official to discuss grading plan and permit requirements. Alternate approaches to grading permitting will be discussed, such as the potential to issue blanket or blocks of Grading Permits for multiple properties that would be excavated in a phase or even the entirety of the work. The goal will be to streamline the plan check and permitting process to the extent possible to expedite the remediation and return of residents to their homes. Grading plans will be prepared in accordance with applicable provisions of the Carson Municipal Code (CMC), enacted through City Ordinance 14-1534U passed March 18, 2014 which adopts the 2014 LA County Grading Code.

The City of Carson issues Grading Permits following LACDPW grading plan review and approval. Experience gained during excavation pilot test grading plan preparation, review, and approval will be of benefit; however, the length of time required for LACDPW review is not within Shell's ability to control. The ability to expedite permit review and approval will be discussed with the City and other agencies as appropriate.

Excavation and Encroachment Permits will be required for equipment staging and operations, lane closures in public streets, and for encroachment onto sidewalks and City property/easements. The City Engineering Department will require a Traffic Management Plan as part of the Encroachment Permit Application. Excavation of trenches for installation of SVE system piping will also require an Encroachment and Excavation Permit from the City. Additionally, groundwater monitoring and LNAPL removal activities require Encroachment Permits from the City of Carson. A Trash Bin/Containers Permit may also be needed for roll-off bins if they will be placed on the street along with the Excavation and Encroachment Permit.

9.3.1.2 South Coast Air Quality Management District Permits

Rule 1166 Contaminated Soil Mitigation Plan

Excavation of VOC- and TPH-impacted soils within the geographic area encompassed by the SCAQMD must be conducted and managed in accordance with the requirements of SCAQMD Rule 1166, Volatile Organic Compound Emissions from Decontamination Soil. Although the volume of soil to be excavated at individual properties will be less than 2,000 cubic yards, which is the maximum volume of VOC-impacted soil that can be excavated under a Rule 1166 Various Locations Permit, based upon the overall scope of the remedial excavation project at 202 homes, with a total estimated soil volume of approximately 144,000 cubic yards plus an additional approximately 8,100 cubic yards for SVE/bioventing piping installation, Shell anticipates that the SCAQMD will require a Site-specific Rule 1166 Contaminated Soil Mitigation Plan for the excavation work. The Rule 1166 Plan will set strict notification, monitoring and enforcement requirements on the work. The Rule 1166 Mitigation Plan will be obtained by the contractor selected to perform the excavation work.

Written records of monitoring data for Rule 1166 monitoring compliance will be kept on field forms in a format approved by the SCAQMD. Within 30 days of completion of excavation work for each phase of work, written records of monitoring of VOC-contaminated soil, daily inspections of any covered stockpiles of VOC-contaminated soil, and disposal of VOC-contaminated soil will be provided to the SCAQMD in accordance with the Site-specific Rule 1166 Permit.

Additionally, excavation of trenches will be done under a Rule 1166 Plan and Permit from the SCAQMD. Based on the volume of soils that will need to be excavated, a Site-specific 1166 Permit will be required. This trenching work could potentially be done under the same 1166 Permit as the excavations on residential properties.

SCAQMD Permit to Construct/Operate

SVE/bioventing equipment will be constructed and operated under a Site-specific SCAQMD Permit to Construct/Operate. The Permit to Construct/Operate will need to be obtained from SCAQMD before the system is constructed and installed. The system will have an effluent discharge stack of sufficient height for dispersion of treated off gases, consistent with modeling results and requirements in the SCAQMD permit to Construct/Operate.

SCAQMD Permits for Sub-slab Depressurization Systems

SCAQMD will require permits for the active operation of the SSD systems. After completion of the diagnostic testing, a permit application will be submitted to SCAQMD for each of the systems.

Asbestos Notifications/Abatement Permits

Because some of the residential building materials used in construction of the homes included asbestos-containing materials, those homes that require installation of a sub-slab mitigation system will require an asbestos survey, and based on the results of that survey, may require permitting from the SCAQMD for abatement of those asbestos containing elements prior to installation of the system.

9.3.1.3 Stormwater Pollution Prevention Plan

Because implementation of Site remedial actions will occur over a period of varying weather conditions, weather will need to be considered during day-to-day activities. Remediation work is expected to continue during the rainy season, and provisions will be included to contain and collect rainwater that may accumulate in work areas and prevent contaminated runoff from exiting work areas and entering the storm drain system.

Prior to the start of excavation work, the excavation contractor will prepare a Stormwater Pollution Prevention Plan (SWPPP) that includes use of best management practices (BMPs) to manage and control stormwater. The SWPPP will be reviewed by URS on behalf of Shell and submitted to the Regional Board for review and approval before beginning work in the rainy season.

9.3.1.4 Other Permits

A number of other permits will need to be obtained to support the remedial excavation aspects of the Site remedy. These permits will be defined as part of the RDIP and PSRP preparation process and

obtained from the respective agency prior to the start of physical onsite work at individual properties. These are anticipated to include:

- The contractor retained to perform the excavation work shall have a valid OSHA Trenching Permit per 29 CFR 1926.650, 29 CFR 1926.651, and 29 CFR 1926.652 and Cal/OSHA Trenching Permit CCR Title 8 Section 341.
- Plumbing and Electrical Permits will be needed if plumbing or electrical service is removed and replaced.
- A Masonry Permit may be required for construction of replacement masonry block walls.
- A Landscaping Permit may be required for restoration of property landscaping.
- The SVE system(s) will be installed in an enclosed structure, which will require plumbing, electrical, building, and construction permits from the City of Carson. The SVE system structure will be constructed with sound attenuation insulation to reduce operating noise levels to decibel (dB) levels at our below the City of Carson Noise Ordinance.

9.3.2 Notifications

At least 72 hours prior to initiation of excavation activities, notifications will be made to appropriate public agencies, including: the Regional Board, SCAQMD, City of Carson Engineering and Planning Departments, LA County Fire Department, and attorneys representing homeowners/residents for parties engaged in litigation against Shell. Shell will also circulate a Fact Sheet and Work Notice that will be distributed to members of the community, elected officials, and other interested parties at least one week before start of the work. Underground Service Alert (USA) will be notified at least 72 hours prior to subsurface activities, to allow marking of underground utilities that may exist in the area, as required by state law.

9.4 HEALTH AND SAFETY

9.4.1 Health and Safety Plan (HSP)

Protecting the health and safety of the public and of Site workers during implementation of remedial actions is of paramount importance to Shell and its consultants and contractors. Pursuant to State of California Division of Occupational Safety and Health (Cal/OSHA) Hazardous Waste Operations Standards (Title 8, CCR Section 5192) and Code of Federal Regulations (Title 40 CFR, Section 1910.120), a project-specific Site-specific Health & Safety Plan (HSP) will be prepared for remedial activities to be conducted at the Site.

All work will be done in accordance with the HSP and Job Safety Analyses (JSAs) that will be prepared for specific work tasks and activities that will be conducted. JSAs will be prepared either by URS or by subcontractors performing specific work activities and will be reviewed and approved by URS prior to start of the work. Site field personnel conducting the work will review applicable JSAs at daily tailgate safety meetings.

9.4.2 Emergency Response Plan

Shell contractors will prepare an Emergency Response Plan that will update the previously-prepared *Carousel Tract Pilot Testing Emergency Response Plan*. The purpose of the Emergency Response Plan (Plan) will be to provide specific information on potential hazards that may arise from the excavation program and subsequent SVE well and piping installation work that could affect the Carousel community and to describe the risk mitigation and emergency response procedures that will be instituted. The Plan will outline roles, responsibilities, and authorities of Shell, URS, and its subcontractors, as well as public agencies who are or may be involved in emergency preparedness, mitigation, and response activities to address potential hazards associated with soil remediation activities at the Carousel Tract. The Plan will outline existing and potential hazards associated with soil, soil vapors, and soil excavation activities, and will describe procedures, communications, and coordination processes for initiating emergency response to safeguard the community in the event of an emergency. The Plan will also provide information on emergency notification services, based on existing public resources. Finally, the Plan will provide a list of important public agency contacts and emergency preparedness resources.

9.5 TENTATIVE SCHEDULE OF ACTIONS TO IMPLEMENT THE RAP

As required by the CAO, provided below is a tentative schedule of actions that will be necessary to implement this RAP. This schedule is conditioned on a number of actions by others that will affect implementation of subsequent activities and therefore must be considered tentative. This tentative schedule does not account for delays due to inclement weather or other acts of God, lack of timely access to properties, extended periods for agency approvals of various plans, and issuance of required permits. Additionally, this assumes that no changes to the remedy set forth in this RAP will be required by the RWQCB or by CEQA review.

As described above in Section 9, following approval of the RAP, a Site-wide RDIP will be prepared. The Site-wide RDIP will provide details on the design and implementation of the planned remedy outlined in this RAP, including excavation, SVE/bioventing, and sub-slab vapor mitigation activities. It will include detailed plans for installation of the site-wide components of the SVE/bioventing system. The Site-wide RDIP will also include an overall site-wide geotechnical evaluation based on existing Site data. A licensed land surveyor will conduct a topographic survey, including comprehensive research of existing utilities, of the public areas of the entire tract. The survey will be referenced to the California State Plane Coordinate System horizontal (North American Datum of 1983 [NAD83]) and vertical (North American Vertical Datum of 1988, 2005 Adjustment [NAVD88]). Existing conditions will also be documented in field notes and photographically. If access can be obtained, property-specific surveys needed for preparation of PSRPs will be conducted at the same time. The Site-wide RDIP is projected to be submitted approximately 12 weeks following approval of the RAP.

In addition to the Site-wide RDIP, PSRPs will be prepared for each property where excavation, SVE/bioventing, or sub-slab vapor mitigation is planned. For properties that will include excavation activities, the PSRP will include a demolition plan, excavation plan and details, fine grading plan and site restoration plan. The PSRP for each parcel will be prepared for submittal to the Regional Board,

City of Carson and LA County DPW. For properties that will include SVE/bioventing activities, the PSRP will identify extraction well locations and sub-grade piping layout. For the properties that will receive sub-slab vapor mitigation, the PSRP will provide design information for the SSD system.

Preparation of these PSRPs is contingent on homeowners providing access for surveying and meeting with Shell's contractor personnel to discuss planned activities, relocation needs, current property conditions, and property restoration following excavation, SVE/bioventing well installation, and SSD installation. Preparation of the PSRPs will start upon approval of the RDIP and will proceed on a rolling basis in phases of eight properties per phase. Approximately six weeks will be needed to complete the PSRPs per phase of eight houses following completion of property surveys, assuming owner access. Preparation of these plans will extend throughout the implementation period over approximately 200 weeks, so that PSRPs are completed and submitted for Regional Board, City, and County review and permit issuance with sufficient lead time prior to field activities at the designated residences. The length of time that LACDPW will take to review and approve grading plans is unknown, but is typically 4 to 6 weeks. During Pilot Test activities, these review and approval activities took several months.

Mobilization for excavation, mitigation system installation, on-property SVE/bioventing well installation, and/or SSD installation will start upon approval of PSRPs and issuance of Grading Permits, and is estimated to take approximately one week. It is assumed that the initial mobilization will occur approximately six months after RAP approval. As described in Section 8.1.3, as currently envisioned excavation will proceed in phases. Following excavation, on-property SVE/bioventing piping and sub-slab mitigation systems will be installed, as appropriate, before backfill and site restoration. The SVE/bioventing wells will be installed following the fine grading activities at each property. Preliminarily, it is estimated that excavation and backfill will take approximately six weeks per property and hardscape restoration and landscaping are estimated to take an additional two weeks. Work on the next phase of properties is planned to begin approximately at the end of week six or eight of work on the first phase. Based on approximately 10 weeks to complete a phase (assuming eight homes per phase and working on four houses at a time for time-to-complete purposes), with overlapping phases as described above, the suite of residential remedial construction activities including excavation, on-property SVE/bioventing well and piping installation, backfill, sub-slab vapor mitigation, and site restoration is estimated to take approximately 5.1 years to complete.

The SVE/bioventing system will require a Permit to Operate/Construct from the SCAQMD. Shell's contractors will begin work on the permit application and required air quality modeling as part of the RDIP process, and the application will be submitted approximately four weeks after approval of RDIP. This schedule is dependent on identifying and securing a location for the SVE treatment system compound(s). As previously noted, Shell is currently communicating with owners/managers at three offsite locations for the SVE compound(s). It is assumed that SCAQMD will complete its review and approval of the SVE system permit application within three months with expedited processing.

SVE/bioventing well installation in the streets will begin upon completion of the first phase of residential excavations, which is projected to begin approximately nine months after RAP approval. Piping installation will begin upon obtaining Permit to Construct/Operate; Shell will seek approval from SCAQMD to begin SVE well and piping installation prior to Permit issuance, but construction of the treatment system cannot begin until the Permit is issued by SCAQMD. Completion of SVE/bioventing well and piping installation will be tied to completion of excavation work plus approximately eight weeks. It is estimated that SVE/bioventing well and piping installation and treatment system installation will be completed approximately 5.6 years after RAP approval.

Upon completion of installation of all elements, SVE/bioventing system startup will begin and will occur over an approximately three month period. Based on preliminary estimates of the duration of remediation system operation to achieve cleanup goals, the SVE/bioventing system may operate for a period of approximately 30 to 40 years. Improved estimates of the potential operating time for the SVE/bioventing system can be made after system startup and operation and analysis of monitoring data. A Five-Year Review Report is anticipated to be completed following five years of full-scale SVE/bioventing system operations. The specific purpose is to review site conditions and monitoring data, evaluate remedy effectiveness and recommend changes in remedy components, if warranted.

10.0 SUMMARY

10.1 INTRODUCTION

This Revised RAP for the former Kast Property (Site) in Carson, California was prepared by URS Corporation (URS) and Geosyntec Consultants, Inc. (Geosyntec) on behalf of Equilon Enterprises LLC, doing business as Shell Oil Products US (Shell or SOPUS) in accordance with CAO No. R4-2011-0046 issued to Shell by the RWQCB on March 11, 2011 and the RWQCB's letter dated January 23, 2014 directing Shell to submit a RAP and Human Health Risk Assessment pursuant to California Water Code Section 13304. A RAP, Feasibility Study (FS) and HHRA were timely submitted to the Regional Board on March 10, 2014 as directed in the RWQCB's January 23, 2014 letter. The Regional Board, along with OEHHA and the UCLA Expert Panel reviewed these documents, and the Regional Board provided comments in its letter dated April 30, 2014. The April 30, 2014 letter directed Shell to submit a Revised RAP, FS, and HHRA addressing the RWQCB, OEHHA and the Expert Panel's comments and directives by June 16, 2014. Per the Regional Board's letter dated June 4, 2014, the submittal date was revised to June 30, 2014. This Revised RAP is being submitted in partial satisfaction of that directive. The Revised HHRA (Geosyntec, 2014c) and Revised FS (Geosyntec, 2014d) are being submitted concurrently as separate documents.

This Revised RAP, along with the Revised HHRA and FS, were prepared to fully address the Regional Board's directives provided beginning on Page 15 of the April 30, 2014 letter. The Revised RAP summarizes the remedial alternative evaluation process provided in the companion Revised FS and identifies and describes recommended full-scale remedial actions for impacted shallow soil and other media at the Site in accordance with requirements of the CAO and directives in the Regional Board's January 23 and April 30, 2014 letters. The Revised RAP and the recommended remedy comply with applicable provisions of the California Health and Safety Code, California Water Code, and SWRCB Resolution 92-49, and in particular, the Regional Board and Expert Panel's comments on the previously submitted RAP dated March 10, 2014.

This Revised RAP and the companion HHRA and FS were prepared following extensive multimedia investigations at the Site from 2008 to present. Key assessment work completed at the Site includes:

- Assessment in public rights-of-way, the adjacent railroad right-of-way, and other non-residential areas including soil, soil vapor, groundwater, and outdoor air media;
- Assessment at 95% of the individual residential properties, including soil, sub-slab soil vapor, and indoor air testing;
- Assessment of environmental impact and feasibility of removal of residual concrete reservoir slabs;
- Pilot testing to evaluate different potential remedies for Site impacts, and
- Development of Site-Specific Cleanup Goals.

The Site has been impacted with petroleum hydrocarbons associated with crude oil storage during the period prior to residential redevelopment. The distribution of hydrocarbons was significantly affected by reservoir demolition and Site grading activities by the developer.

10.2 CONSTITUENTS OF CONCERN (COCS) AND HUMAN HEALTH RISK ASSESSMENT

Crude oil is a complex mixture of petroleum hydrocarbon compounds. Hydrocarbon impacts in shallow and deep soils were quantified as gasoline-range (TPHg), diesel-range (TPHd), and motor oil-range (TPHmo) hydrocarbons together with VOCs, SVOCs, including PAHs; VOCs, including benzene, and methane were quantified in soil vapor (also referred to as soil gas); dissolved-phase VOC and TPH impacts were evaluated in groundwater, and LNAPL consisting of crude oil locally present in groundwater has been assessed and defined. In addition to hydrocarbon-related impacts, impacts are also locally present from chlorinated solvents, such as PCE and TCE, and from THMs associated with potable water treatment provided by the water service purveyor. Although the chlorinated solvents TCE and PCE are found sporadically around the Site in shallow soils, their presence in groundwater is related to offsite sources. Because THMs are related to drinking water delivered to the Site by Cal-Water, THMs are not considered Site-related COCs.

Some of these compounds, referred to as constituents of concern (COCs), are present at concentrations that result in estimates of incremental lifetime cancer risk (ILCR) and noncancer hazard that are above regulatory thresholds or may pose a concern for the potential leaching to groundwater pathway. Although exposure to methane does not, by itself, pose a risk to human health, if methane accumulates in an enclosed space at a concentration between approximately 5% (termed the lower explosive limit, LEL) and 15% (termed the upper explosive limit, UEL) in the presence of sufficient oxygen and a source of ignition is present, methane may pose a combustion or explosion hazard. Methane in soil vapor at depth does not pose a combustion or explosion hazard.

Groundwater is impacted with Site COCs as well as with those attributed to upgradient sources; COCs attributed to offsite sources are discussed in detail in the Revised SSCG Report (Geosyntec, 2013c). These non-Site related COCs include tert-butyl alcohol (TBA), TCE and PCE. Site-related COCs in groundwater exceeding California MCLs or NLs are benzene, naphthalene, and arsenic, and TPH also exceeds the San Francisco Bay Regional Water Quality Control Board ESLs.

The Revised HHRA, summarized in Section 6 of this Revised RAP, has been modified to address comments by the Regional Board, OEHHA, and the Expert Panel. The objective of the HHRA was to evaluate potential human health impacts to onsite residents and onsite construction and utility maintenance workers prior to any remediation efforts at the Site (baseline condition), to evaluate potential COC leaching from soil to groundwater, and to use as a predictive tool in the remedial decision-making process to determine if further action is warranted for areas of the Site. Cumulative estimates of incremental lifetime cancer risks and noncancer hazard indices have been provided across media to address the comments received by the Expert Panel (RWQCB, 2014d).

The HHRA addressed potential onsite exposures to residents and construction and utility maintenance workers. Potential exposures to COCs detected in shallow soils were evaluated for the

direct contact pathways, as well as inhalation of volatile COCs in outdoor air and nonvolatile COCs in fugitive dust. The potential for volatile COCs to migrate from the subsurface (using sub-slab soil vapor data) into residential structures present above ground was evaluated for a resident.

10.3 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) have been developed for soil, soil vapor, and groundwater based on Site characterization investigations completed at the Site. These RAOs include:

- Prevent human exposures to concentrations of COCs in soil, soil vapor, and indoor air such that total (i.e., cumulative) lifetime incremental cancer risks are within the NCP risk range of one in one million to one hundred in one million (1×10^{-6} to 1×10^{-4}) and noncancer Hazard Indices are less than 1 or concentrations are below background, whichever is higher. Potential human exposures include onsite residents and construction and utility maintenance workers. For onsite residents, the lower end of the NCP risk range (i.e., 1×10^{-6}) and a noncancer hazard index less than 1 have been used.
- Prevent fire/explosion risks in indoor air and/or enclosed spaces (e.g., utility vaults) due to the accumulation of methane generated from the anaerobic biodegradation of petroleum hydrocarbons in soils. Eliminate methane in the subsurface to the extent technologically and economically feasible.
- Remove or treat LNAPL to the extent technologically and economically feasible, and where a significant reduction in current and future risk to groundwater will result.
- Reduce COCs in groundwater to the extent technologically and economically feasible to achieve, at a minimum, the water quality objectives in the Basin Plan to protect the designated beneficial uses, including municipal supply.

A further consideration is to maintain residential land-use of the Site and avoid displacing residents from their homes or physically divide the established Carousel community.

10.4 FEASIBILITY STUDY

The Revised FS Report, which is a companion document to the Revised RAP and is summarized in Section 7 above, identified and screened a range of remedial technologies potentially applicable to site cleanup. Technologies that remained for consideration following technology screening included:

- Potential sub-slab vapor intrusion mitigation;
- Capping portions of the Site;
- Institutional controls, which restrict access to impacted media;
- Excavation;
- Soil vapor extraction (SVE);
- Bioventing;

- LNAPL/source removal;
- Monitored natural attenuation (MNA); and
- Removal of residual concrete reservoir slabs.

These technologies were then assembled into remedial alternatives that were subjected to initial screening and detailed evaluation for cleanup of the Site. Remedial alternatives that remained after screening, and the specific technologies included in those alternatives, are summarized below:

- Alternative 1 – No Action.
- Alternative 4 – Excavation of Site soils from both landscaped areas and beneath residential hardscape; existing institutional controls; SVE/bioventing; sub-slab mitigation; removal of LNAPL; groundwater MNA, and potentially supplemental groundwater remediation (e.g., in areas exceeding 100x MCLs). Four separate excavation depth alternatives in this category were evaluated in the FS Report, excavation to 3 feet bgs, 5 feet bgs, 5 feet bgs with targeted deeper excavation to 10 feet bgs, and 10 feet bgs.
- Alternative 5 – Excavation of Site soils from landscaped areas only; existing and new institutional controls; SVE/bioventing; sub-slab mitigation; removal of LNAPL; groundwater MNA, and potentially supplemental groundwater remediation. The same four excavation depth alternatives were evaluated for this category as were evaluated for Alternative 4.
- Alternative 7 – Capping the landscaped areas of the Site; existing and new institutional controls; SVE/bioventing; sub-slab mitigation; removal of LNAPL; groundwater MNA, and potentially supplemental groundwater remediation.

For the detailed evaluation, the Revised FS Report used as guidance the nine criteria that are identified in the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988). In addition, the Revised FS Report used three criteria that address key Site-specific issues of importance to alternative evaluation:

- Consistency with Resolution 92-49;
- Social Considerations; and
- Sustainability.

10.5 RECOMMENDED REMEDIAL ACTION

Based upon the results of the Revised HHRA (Geosyntec, 2014c) and Revised FS (Geosyntec, 2014d), and in consideration of the comprehensive Site characterization data, RAOs for the Site, the Regional Board's and Expert Panel's comments contained in the RWQCB correspondence dated April 30, 2014 and May 29, 2014, and additional direction received from the Regional Board, the following multi-media remedial actions were selected as the recommended remedy for the Site.

- Excavation of shallow soils at impacted residential properties where RAOs and the more stringent of the health risk-based or leaching to groundwater criteria are not met under existing conditions. Excavation will be to a depth of 5 feet bgs at accessible portions of both landscaped and hardscaped areas of residential yards from 202 properties (shown on Figure 6-1).
- Local targeted deeper excavations from 5 to 10 feet bgs at approximately 82 properties (shown on Figure 6-3) in areas where significant additional hydrocarbon mass can be removed. Excavations to 10 feet bgs will be at locations where TPH SSCGs are exceeded by a factor of 10 times and will be conducted using a combination of conventional and auger excavation methods.
- Residual concrete reservoir slabs will be removed if encountered in excavations, to the extent practicable and where it can be done safely.
- Post-excavation soil samples will be collected and analyzed from sidewalls of excavations, as appropriate.
- Landscaping and removed hardscape will be restored following excavation.
- A robust SVE/bioventing system, with SVE/bioventing wells in City streets and on residential properties, will be installed and operated to extract VOCs and methane and to promote degradation of residual hydrocarbon concentrations via bioventing where RAOs are not met following soil excavation. Bioventing will be integral with SVE via cyclical operation of SVE wells. Bioventing in concert with SVE will be used to increase oxygen levels in subsurface soils and promote microbial activity and degradation of longer-chain petroleum hydrocarbons.
- Sub-slab mitigation will be implemented at 28 properties (shown on Figure 6-4) where RAOs are not met based on theoretical calculated vapor intrusion exposures or methane concentrations in sub-slab soil vapor exceed the upper RAO for methane of 0.5%. In addition, while the data do not indicate that vapor intrusion is an issue at any of the residences, Shell is prepared to offer installation of a sub-slab mitigation system to any of the homeowners in the Carousel neighborhood to alleviate concerns about potential impacts to their indoor air from the Site.
- The recommended remedy includes a comprehensive long-term monitoring plan that will include monitoring of:
    - Sub-slab soil vapor probes at properties scheduled for remedial excavation until the SVE/bioventing system becomes operational and periodically thereafter;
    - Select soil vapor probe locations in City streets until the SVE/bioventing system becomes operational; thereafter, monitoring will be conducted at newly installed shallow and multi-depth soil vapor probes;
    - Utility boxes and other Site features previously monitored until the SVE/bioventing system becomes operational;

  - SVE/bioventing system operations and maintenance (O&M) and system effectiveness sampling will be conducted periodically.

- LNAPL will be recovered where it has accumulated in monitoring wells MW-3 and MW-12 and in additional wells if it accumulates at a measurable thickness, to the extent technologically and economically feasible, and where a significant reduction in current and future risk to groundwater will result. The goal for LNAPL removal will be no measurable thickness in wells.

- COCs in groundwater will be reduced to the extent technologically and economically feasible via source reduction and monitored natural attenuation (MNA). MNA could be paired with contingency groundwater remediation of oxidant injection in areas where Site-related COCs exceed 100x MCL if, after a five-year review following start of SVE/bioventing operations, the groundwater plume is not stable or decreasing. In addition, upgradient sources would need to be addressed by the overseeing agencies.

- The shallow soil remedy includes a Surface Containment and Soil Management Plan to address notifications, management, and handling of residual soils below the depth of excavation and that are impacted by COCs at concentrations greater than risk-based levels. Soils remaining below 5 feet bgs and impacted soils beneath City streets and sidewalks will be addressed through the Surface Containment and Soil Management Plan (Appendix C). Implementation of the Surface Containment and Soil Management Plan can be accomplished through the City of Carson permitting process, as the Carson Municipal Code is an existing institutional control that requires that a Grading Permit be obtained for excavations deeper than 3 feet. In addition, Shell will implement a community outreach program to inform and educate residents in the community of residual impacted soils and of the notification procedures for management of these materials via the Surface Containment and Soil Management Plan.

These remedial actions are intended to achieve the RAOs and the RWQCB-approved SSCGs for soil, soil vapor, and groundwater as directed in the Regional Board's Review of the Revised SSCG Report and Directive dated January 23, 2014 and Review of the March 10, 2014 RAP, HHRA and FS dated April 30, 2014, and SSCG clarification letter dated May 29, 2014.

Following approval of the RAP, a Site-wide Remedial Design and Implementation Plan (RDIP) will be prepared. The Site-wide RDIP will provide details on the design and implementation of the planned remedy, including excavation, SVE/bioventing, and sub-slab vapor mitigation activities. It will include detailed plans for installation of the non-property specific components of the SVE/bioventing system. In addition, Property-Specific Remediation Plans (PSRPs) will be prepared for each property where remedial work will occur that will present detailed plans for remedial activities on a property-by-property basis, including site restoration.

The tentative schedule of actions to implement the RAP is discussed in Section 9.5. Certain items, including agency review and approval of the RDIP and PSRPs, review of grading plans and permit applications by the City of Carson and LA County DPW and issuance of Grading Permits, issuance

of the Permit to Operate/Construct for the SVE/bioventing treatment system by SCAQMD, and obtaining access at the individual properties, may take longer than estimated and are outside the control of Shell and its consultants. The construction phase of Site remediation, including installation of the SVE/bioventing system is expected to take approximately 5.6 years after RAP approval. Upon completion of installation of all elements, SVE/bioventing system startup will begin and will occur over an approximately three month period. Based on preliminary estimates of the duration of remediation system operation to achieve cleanup goals, the SVE/bioventing system may operate for a period of approximately 30 to 40 years.

11.0 REFERENCES

California Department of Conservation Division of Oil, Gas and Geothermal Resources (CDOGGR), 1998. CDOGGR Map No. 128.

California Department of Water Resources (DWR), 1961. Planned Utilization of the Groundwater Basins on the Coastal Plain of Los Angeles County, Bulletin # 104. June 1961.

California Environmental Protection Agency, Department of Toxic Substances Control (Cal-EPA DTSC), 1997. Selecting Inorganic Constituents as Chemicals of Potential Concern at Risk Assessments at Hazardous Waste Sites and Permitted Facilities. February 1997.

Cal-EPA DTSC, 2009a. Interim Guidance: Evaluating Human Health Risks from Total Petroleum Hydrocarbons. URL: www.dtsc.ca.gov/AssessingRisk/upload/TPH-Guidance-6_16_09.pdf

Cal-EPA DTSC, 2009b. Revised California Human Health Screening Levels for Lead. September 2009.

Cal-EPA DTSC, 2009c. Use of the Northern and Southern California Polynuclear Aromatic Hydrocarbon (PAH) Studies in the Manufactured Gas Plant Site Cleanup Process. July 1, 2009.

Cal-EPA DTSC, 2009d. Arsenic Strategies, Determination of Arsenic Remediation, Development of Arsenic Cleanup Goals. January 16, 2009.

California Water Service Company, 2013. 2012 Water Quality Report, Rancho Dominguez District. https://www.calwater.com/docs/ccr/2012/rd-dom-2012.pdf

Department of Toxic Substances Control (DTSC), 1995. Remedial Action Plan (RAP) Policy, Official Policy / Procedure Document No. EO-95-007-PP. November 16, 1995.

DTSC, 2005. Advisory on Methane Assessment and Common Remedies at School Sites, School Property Evaluation and Cleanup Division, June 16, 2005.

DTSC, 2008. Letter to RWQCB re: Inquiry on Regulatory Status and Investigation of Former Shell Oil Tank Farm Adjacent to Former Turco Products, Inc., 24700 South Main Street, Carson, California (EPA ID No. CAD096004742), March 11, 2008.

DTSC, 2011. Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance). October 2011.

Ecology and Environment, 2013. Site Assessment Report, Monterey Pines Development Site, Carson, California. Report prepared for U.S. Environmental Protection Agency, Region 9. August 2013.

Equilon Enterprises, LLC, 2001. Revised Soil and Groundwater Quality Management Program - Equilon Los Angeles Refining Company, Former Texaco Refinery, 2101 Pacific Coast Highway, Wilmington, CA (Cleanup and Abatement Order No. 88-070, SLIC No.230). June 29, 2001.

Geosyntec Consultants (Geosyntec), 2009a. Indoor Air Sampling and Analysis Work Plan, Former Kast Property, Carson, California. October 21, 2009.

Geosyntec, 2009b. Human Health Screening Evaluation Work Plan, Former Kast Property, Carson, California. October 30, 2009.

Geosyntec, 2010a. Data Evaluation and Decision Matrix, Former Kast Property, Carson California, Site Cleanup No. 1230, Site ID. 2040330. April 6, 2010.

Geosyntec, 2010b. Site Conceptual Model, Former Kast Property, Carson California, Site Cleanup No. 1230, Site ID. 2040330. September 2010.

Geosyntec, 2010c. Letter re: Addendum to the HHSE Work Plan, Former Kast Property, Carson California, Site Cleanup No. 1230, Site ID. 2040330. December 17, 2010.

Geosyntec, 2011. Letter re: Risk-Based Screening Levels for Total Petroleum Hydrocarbons, Former Kast Property, Carson California, Site Cleanup No. 1230, Site ID. 2040330. August 15, 2011.

Geosyntec, 2012a. Technical Memorandum re: Revised In-Situ Chemical Oxidation Pilot Test – Bench-scale Evaluation, Former Kast Property, Carson, California. July 16, 2012.

Geosyntec, 2012b. Bioventing Pilot Test Summary Report. Former Kast Property, Carson, California. December 6, 2012.

Geosyntec, 2013a. Phase II ISCO Bench-Scale Test Workplan, Former Kast Property, Carson, California. March 15, 2013.

Geosyntec, 2013b. Phase II ISCO Bench-Scale Test Report, Former Kast Property, Carson, California. August 30, 2013.

Geosyntec, 2013c. Revised Site Specific Cleanup Goals Report, Former Kast Property, Carson California. October 21, 2013.

Geosyntec, 2013d. Revised Community Outdoor Air Sampling Report, Former Kast Property, Carson, California, Cleanup No. 1230, Site ID. 2040330. November 27, 2013.

Geosyntec, 2014a. Human Health Risk Assessment Report, Former Kast Property, Carson, California, Site Cleanup No. 1230, Site ID. 2040330. March 10, 2014.

Geosyntec, 2014b. Feasibility Study, Former Kast Property, Carson, California. March 10, 2014.

Geosyntec, 2014c. Revised Human Health Risk Assessment Report, Former Kast Property, Carson, California, Site Cleanup No. 1230, Site ID. 2040330. June 30, 2014.

Geosyntec, 2014d. Revised Feasibility Study, Former Kast Property, Carson, California. June 30, 2014.

Interstate Technology & Regulatory Council (ITRC), 2009. Evaluating Natural Source Zone Depletion at Sites with LNAPL, April, 2009.

Leymaster, 2013. Semi Annual Monitoring Report-Second Half 2012, Former Turco Facility, 24700 Main Street, Carson, California, January 31, 2013.

Los Angeles County Road Department Permit Division (LAC), Undated. Pipeline maps W-301 and W-312.

PIC Environmental Services, 1995a. Tank Removal Report. November 15.

PIC Environmental Services, 1995b. Excavation Geologic Report for Blue Jay Project. December 7.

Regional Water Quality Control Board, Los Angeles Region (RWQCB), 1996a. Interim Site Assessment and Cleanup Guidebook, May 1996.

RWQCB, 1996b. No Further Action Letter to PIC Environmental Services, September 30,1996b.

RWQCB, 2009. Letter to Shell re: Approval of Work Plan for Phase II Site Characterization Pursuant to California Water Code Section 13267 Order for Former Shell Oil Company Kast Property Tank Farm Located at South East of the Intersection of Marbella Avenue and East 244th Street, Carson, California (Site Cleanup No. 1230, Site ID 2040330. September 24, 2009.

RWQCB, 2014a. Letter to Sanitation District No. 8 of Los Angeles County re: Regional Board Cross Sections, Former Fletcher Oil Company (FORCO) Site, 24721 S. Main Street, Carson, California (SCP No. 0451A, Site ID No. 2040074). January 14, 2014.

RWQCB, 2014b. Review of Revised Site-Specific Cleanup Goal Report and Directive to Submit Remedial Acton Plan, Human Health Risk Analyses, and Environmental Analyses for Cleanup of the Carousel Tract Pursuant to California Water Code Section 13304. January 23.

RWQCB, 2014c. Clarification and Revision of Regional Board's January 13, 2014 Review of Assessment of Environmental Impact and Feasibility of Removal of Residual Concrete Reservoir Slabs Pursuant to Water Code Section 13304, Former Kast Property Tank Farm Located Southeast of the Intersection of Marbella Avenue and East 244th Street, Carson, California (SCP No. 1230, Site ID No. 2040330, CAO No. R4-2011-0046). February 10.

RWQCB, 2014d. Review of Remedial Action Plan, Feasibility Study Report and Human Health Risk Assessment Report Pursuant to California Water Code Section 13304 Order. Letter to Shell Oil Products US dated April 30, 2014.

RWQCB, 2014e. Revised Site Specific Cleanup Goals for Total Petroleum Hydrocarbons as Motor Oil and Benzene. Letter to Shell Oil Products US dated May 29, 2014.

San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), 2013. User's Guide: Derivation and Application of Environmental Screening Levels, Interim Final. December 23, 2013.

Sepich, John, 2013. Methane Risk at Former Kast Property Residential Development. Prepared for Shell Oil Products US by Brownfield Subslab, February 21, 2013.

Shell Oil Products US (SOPUS), 2010. Completed RWQCB Chemical Storage and Use Questionnaire. August 31, 2010.

SOPUS, 2013. Draft Public Participation Plan (PPP). September 17, 2013.

State Water Resources Control Board (SWRCB), 1992. Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304, Resolution 92-49. Amended October 2, 1996.

SWRCB, 2011. A Compilation of Water Quality Goals, 16th Edition. April 2011.

SWRCB, 2012. Leaking Underground Fuel Tank Guidance Manual. September 2012.

Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG), 1997. Selection of Representative TPH Fractions Based on Fate and Transport Considerations. TPHCWG Series. Volume 3. July 1997.

United States Environmental Protection Agency (USEPA), 1991. The Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions.

USEPA, 1999. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. Office of Solid Waste Emergency Response, Directive 9200.4-17P. April.

USEPA, 2003. Assessing Intermittent or Variable Exposures at Lead Sites. OSWER #9285.7-76. November 2003.

URS Corporation (URS), 2008a. Phase I Environmental Site Assessment Report, Former Kast Property, Carson, California, July 2008

URS, 2008b. Addendum to Site Characterization Work Plan, Former Kast Property, Carson, California.

URS, 2009a. Interim Site Characterization Report, Former Kast Property, Carson, California, August 20, 2009.

URS, 2009b. Work Plan for Phase II Site Characterization, Former Kast Property, Carson California, September 21, 2009.

URS, 2009c. Final Phase I Site Characterization Report, Former Kast Property, Carson, California, October 15, 2009.

URS, 2010a. Plume Delineation Report, Former Kast Property, Carson, California . September 29, 2010.

URS, 2010b. IRAP Further Site Characterization Report, Former Kast Property, Carson, California, February 2010.

URS, 2010c. Addendum Work Plan for Phase II Site Characterization, Additional Sampling of Residential Properties, Former Kast Property, Carson, California. April 19, 2010.

URS, 2010d. Addendum to the IRAP, Further Site Characterization Report and SVE Pilot Test Work Plan, Former Kast Property, Carson California, April 30, 2010.

URS, 2010e. Soil Background Evaluation Report. Former Kast Property, Carson, California, September 14, 2010.

URS, 2010f. Soil Vapor Extraction Pilot Test Report, Former Kast Property, Carson, California, Site Cleanup No. 1230, Site ID 2040330. September 30, 2010.

URS, 2011a. Technical Memorandum Summary of Findings from Gage Pilot Holes and Recommendations for Gage Monitoring Wells, Former Kast Property, Carson, California, May 11, 2011.

URS, 2011b. Supplemental Site Delineation Report, Former Kast Property, Carson, California, May 27, 2011.

URS, 2011c. Gage Aquifer Investigation Report, Former Kast Property, Carson, California, October 10, 2011.

URS, 2012a. Plume Delineation Work Plan, Former Kast Property, Carson, California, January 12, 2010.

URS, 2012b. Addendum No. 1 to Supplemental Site Delineation Report, Sampling of Existing Soil Vapor Probes, Installation of Step-out Soil Vapor Probes, and Step-Out Soil Borings, Carousel and Monterey Pines Neighborhoods and Island Avenue, Former Kast Property, Carson, California March 1, 2012

URS, 2013a. Report, Excavation Pilot Test, 24612 Neptune Avenue, Former Kast Property, Carson, California. January 4, 2013.

URS, 2013b. Report, Excavation Pilot Test, 24533 Ravenna Avenue, Former Kast Property, Carson, California. February 4, 2013.

URS, 2013c. Delineation of Tar-Like Material in the Vicinity of AT&T Excavations Near the Intersection of 244th Street and Marbella Avenue, Former Kast Property, Carson, California, February 27, 2013.

URS, 2013d. Pilot Test Summary Report – Part 2, Former Kast Property, Carson, California, Cleanup No. 1230, Site ID. 2040330, August 30, 2013.

URS, 2013e. Assessment of Environmental Impact and Feasibility of Removal of Residual Concrete Reservoir Slabs, Former Kast Property, Carson, California. June 28, 2013.

URS and Geosyntec, 2010a. Community Outdoor Air Sampling and Analysis Report, Former Kast Property, Carson, California, Cleanup No. 1230, Site ID. 2040330. November 5, 2010

URS and Geosyntec, 2010b. Soil Background Evaluation Report, Former Kast Property, Carson, California, September 15, 2010.

URS and Geosyntec, 2011. Pilot Test Work Plan, Remedial Excavation and In-Situ Treatment Pilot Testing, Former Kast Property, Carson, California, May 10, 2011.

URS and Geosyntec, 2013. Final Pilot Test Summary Report – Part 1, Former Kast Property, Carson, California, Cleanup No. 1230, Site ID. 2040330, May 30, 2013.

Water Replenishment District (WRD), 2008. Groundwater Quality in the Central and West Coast Basins.

TABLES

Table 5-1

Site-Specific Cleanup Goals for Soil

Former Kast Property

CAS Number	Constituents of Concern	$SSCG_{soil\text{-}GW}$[1] (mg/kg)	(BTV)[2] (mg/kg)	Soil Site-Specific Cleanup Goals (mg/kg)					
				Onsite Resident				Construction and Utility Maintenance Worker	
				EF = 350 d/y		EF = 4 d/y			
				SSCG (mg/kg)	Basis	SSCG (mg/kg)	Basis	SSCG (mg/kg)	Basis
	Inorganics								
7440-36-0	Antimony	2.7E-01	7.4E-01	3.1E+01	nc	2.7E+03	nc	3.1E+03	nc
7440-38-2	Arsenic	--	1.2E+01	6.1E-02	c	5.4E+00	c	1.5E+01	c
7440-43-9	Cadmium	--	3.8E+00	7.0E+01	nc	6.2E+03	nc	2.4E+02	c
18540-29-9	Chromium VI	--	--	1.3E+00	c	1.1E+02	c	6.7E+00	c
7440-48-4	Cobalt	--	1.1E+01	2.3E+01	nc	2.1E+03	nc	1.1E+02	c
7440-50-8	Copper	--	5.9E+01	3.1E+03	nc	2.7E+05	nc*	3.1E+05	nc*
7439-92-1	Lead	--	6.1E+01	8.0E+01[3]	--	8.2E+02[4]	--	8.2E+02[5]	--
7440-28-0	Thallium	1.4E-01	2.3E-01	7.8E-01	nc	6.8E+01	nc	7.7E+01	nc
7440-62-2	Vanadium	--	4.6E+01	3.9E+02	nc	3.4E+04	nc	3.3E+03	nc
7440-66-6	Zinc	--	2.9E+02	2.3E+04	nc	2.1E+06	nc*	2.3E+06	nc*
	PAHs								
56-55-3	Benz[a]anthracene	--	--	1.6E+00	c	1.4E+02	c	2.6E+02	c
50-32-8	Benzo[a]pyrene	--	9.0E-01	1.6E-01	c	1.4E+01	c	2.6E+01	c
205-99-2	Benzo[b]fluoranthene	--	--	1.6E+00	c	1.4E+02	c	2.6E+02	c
207-08-9	Benzo[k]fluoranthene	--	--	1.6E+00	c	1.4E+02	c	2.6E+02	c
218-01-9	Chrysene	--	--	1.6E+01	c	1.4E+03	c	2.6E+03	c
53-70-3	Dibenz[a,h]anthracene	--	--	1.1E-01	c	9.7E+00	c	1.9E+01	c
193-39-5	Indeno[1,2,3-cd]pyrene	--	--	1.6E+00	c	1.4E+02	c	2.6E+02	c
90-12-0	Methylnaphthalene, 1-	--	--	1.6E+01	c	1.4E+03	c	2.7E+03	c
91-57-6	Methylnaphthalene, 2-	--	--	2.3E+02	nc	2.0E+04	nc	1.1E+04	nc
91-20-3	Naphthalene	1.4E+01	--	4.0E+00	c	3.5E+02	c	3.9E+01	c
129-00-0	Pyrene	--	--	1.7E+03	nc	1.5E+05	nc*	6.7E+04	nc
	TPH								
	TPHg	117	--	7.6E+02	nc	6.6E+04	nc*	8.6E+02	nc
	TPHd	625	--	1.3E+03	nc	1.1E+05	nc*	1.9E+03	nc
	TPHmo	10000	--	3.3E+03	nc	2.9E+05	nc*	1.6E+05	nc*
	SVOCs								
121-14-2	2,4-Dinitrotoluene	--	--	1.6E+00	c	1.4E+02	c	2.8E+02	c
117-81-7	Bis(2-Ethylhexyl) Phthalate	--	--	3.5E+01	c	3.0E+03	c	6.4E+03	c
	VOCs								
79-34-5	1,1,2,2-Tetrachloroethane	--	--	4.7E-01	c	4.1E+01	c	5.7E+00	c
96-18-4	1,2,3-Trichloropropane	4.2E-06	--	2.1E-02	c	1.9E+00	c	2.0E+00	nc
95-63-6	1,2,4-Trimethylbenzene	--	--	8.3E+01	nc	7.2E+03	nc	7.5E+01	nc
107-06-2	1,2-Dichloroethane	3.2E-04	--	--		--		--	
156-59-2	cis-1,2-Dichloroethene	3.9E-03	--	--		--		--	
78-87-5	1,2-Dichloropropane	--	--	8.3E-01	c	7.2E+01	c	8.5E+00	c
108-67-8	1,3,5-Trimethylbenzene	--	--	8.5E+01	nc	7.4E+03	nc	7.7E+01	nc

Table 5-1

Site-Specific Cleanup Goals for Soil

Former Kast Property

CAS Number	Constituents of Concern	$SSCG_{soil-GW}$[1] (mg/kg)	(BTV)[2] (mg/kg)	Soil Site-Specific Cleanup Goals (mg/kg)					
				Onsite Resident				Construction and Utility Maintenance Worker	
				EF = 350 d/y		EF = 4 d/y			
				SSCG (mg/kg)	Basis	SSCG (mg/kg)	Basis	SSCG (mg/kg)	Basis
106-46-7	1,4-Dichlorobenzene	1.2E-02	--	2.8E+00	c	2.4E+02	c	2.8E+01	c
71-43-2	Benzene	2.1E-02	--	2.2E-01	c	1.9E+01	c	2.2E+00	c
75-27-4	Bromodichloromethane	--	--	4.9E-01	c	4.2E+01	c	5.3E+00	c
74-83-9	Bromomethane	--	--	8.8E+00	nc	7.7E+02	nc	7.8E+00	nc
100-41-4	Ethylbenzene	--	--	4.8E+00	c	4.2E+02	c	5.1E+01	c
75-09-2	Methylene chloride	--	--	5.3E+00	c	4.7E+02	c	5.9E+01	c
75-65-0	tert-Butyl Alcohol	7.9E-03	--	--		--		--	
127-18-4	Tetrachloroethene	5.8E-03	--	5.5E-01	c	4.9E+01	c	1.0E+01	c
108-88-3	Toluene	--	--	4.8E+03	nc	4.2E+05	nc*	1.6E+04	nc
79-01-6	Trichloroethene	3.2E-03	--	1.2E+00	c	1.0E+02	c	5.5E+00	nc
75-01-4	Vinyl chloride	3.2E-04	--	3.2E-02	c	2.8E+00	c	3.1E-01	c
1330-20-7	Xylene, total	--	--	5.6E+02	nc	4.9E+04	nc	4.7E+02	nc

Notes:

" -- " not applicable or not available

EF = exposure frequency; d/y = days per year

TPHg = Total Petroleum Hydrocarbons- gasoline range

TPHd = Total Petroleum Hydrocarbons- diesel range

TPHmo = Total Petroleum Hydrocarbons- motor oil range

nc = SSCG based on noncancer effects; c = SSCG based on cancer effects

* Values are above Csat, 1E+05 or Cres

[1] A $SSCG_{soil-GW}$ value was only listed for those COCs identified for potential soil leaching to groundwater. These $SSCG_{soil-GW}$ are from the January 23, 2014 letter from the Regional Board on the Revised SSCG Report (RWQCB, 2014b) as corrected in the May 29, 2014 letter from the Regional Board for benzene and TPH-mo (RWQCB, 2014e).

[2] To evaluate potential human health exposures, the higher value between the health-based SSCG and Background Threshold Value (BTV) will be selected as the cleanup goal. To evaluate potential leaching to groundwater, the higher between $SSCG_{soil-GW}$ and BTV will be will be selected as the cleanup goal.

[3] Cal-EPA DTSC, 2009b. Revised California Human Health Screening Levels for Lead. September 2009.

[4] Based on USEPA adult lead model (USEPA, 2003), similar parameters used for the residential CHHSL, and a lower exposure frequency.

[5] Based on USEPA adult lead model (USEPA, 2003), similar parameters used for the industrial worker CHHSL, and a lower exposure frequency.

Table 5-2

Site-Specific Cleanup Goals for Sub-Slab and Soil Vapor

Former Kast Property

CAS Number		Odor-Based SSCG[1] (µg/m³)	Sub-Slab and Soil Vapor		Soil Vapor	
			Onsite Resident		Construction and Utility Maintenance Worker	
			SSCG (µg/m³)	Basis	SSCG (µg/m³)	Basis
79-34-5	1,1,2,2-Tetrachloroethane	5.2E+06	2.1E+01	c	1.2E+05	c
79-00-5	1,1,2-Trichloroethane	--	7.5E+01	c	1.0E+05	nc
75-34-3	1,1-Dichloroethane	6.3E+07	7.6E+02	c	2.5E+07	c
120-82-1	1,2,4-Trichlorobenzene	1.1E+07	1.0E+03	nc	3.9E+05	nc
95-63-6	1,2,4-Trimethylbenzene	--	3.7E+03	nc	2.3E+06	nc
107-06-2	1,2-Dichloroethane	1.2E+06	5.9E+01	c	8.5E+05	c
78-87-5	1,2-Dichloropropane	6.0E+05	1.2E+02	c	2.5E+06	c
108-67-8	1,3,5-Trimethylbenzene	--	3.7E+03	nc	2.3E+06	nc
106-99-0	1,3-Butadiene	--	7.2E+00	c	3.0E+05	c
106-46-7	1,4-Dichlorobenzene	5.5E+05	1.1E+02	c	7.2E+05	c
123-91-1	1,4-Dioxane	3.1E+08	1.6E+02	c	1.6E+05	c
540-84-1	2,2,4-Trimethylpentane	--	5.2E+05	nc	6.5E+08	nc
591-78-6	2-Hexanone	--	1.6E+04	nc	7.9E+06	nc
622-96-8	4-Ethyltoluene	--	5.2E+04	nc	2.5E+07	nc
71-43-2	Benzene	2.4E+06	4.2E+01	c	1.0E+06	c
75-27-4	Bromodichloromethane	5.5E+09	3.3E+01	c	7.8E+05	c
74-83-9	Bromomethane	4.0E+07	2.6E+03	nc	9.5E+06	nc
75-15-0	Carbon disulfide	--	3.7E+05	nc	1.4E+09	nc
56-23-5	Carbon tetrachloride	3.2E+07	2.9E+01	c	1.1E+06	c
67-66-3	Chloroform	2.1E+08	2.3E+02	c	4.9E+06	c
110-82-7	Cyclohexane	--	3.1E+06	nc	1.8E+10	nc
124-48-1	Dibromochloromethane	--	4.5E+01	c	8.8E+05	c
156-59-2	Dichloroethene, cis-1,2-	3.4E+07	3.7E+03	nc	8.3E+06	nc
156-60-5	Dichloroethene, trans-1,2-	3.4E+07	3.1E+04	nc	9.3E+07	nc
10061-02-6	Dichloropropene, trans-1,3-	2.1E+06	7.6E+01	c	3.9E+06	c
64-17-5	Ethanol	--	2.1E+06	nc	1.9E+08	nc
100-41-4	Ethylbenzene	1.0E+06	4.9E+02	c	7.0E+06	c
142-82-5	Heptane	--	3.7E+05	nc	2.3E+09	nc
87-68-3	Hexachloro-1,3-butadiene	6.0E+06	5.5E+01	c	8.0E+04	c
110-54-3	Hexane	--	3.7E+05	nc	1.7E+09	nc
67-63-0	Isopropanol	--	3.7E+06	nc	5.7E+08	nc
98-82-8	Isopropylbenzene (cumene)	--	2.1E+05	nc	1.5E+09	nc
78-93-3	Methyl ethyl ketone (2-butanone)	1.6E+07	2.6E+06	nc	1.1E+09	nc
75-09-2	Methylene chloride	2.8E+08	1.2E+03	c	2.8E+07	c
1634-04-4	Methyl-tert-butyl ether	2.7E+05	4.7E+03	c	6.5E+07	c
91-20-3	Naphthalene	2.2E+05	3.6E+01	c	6.3E+04	c
103-65-1	Propylbenzene	--	5.2E+05	nc	6.6E+08	nc
75-65-0	tert-Butyl Alcohol (TBA)	--	5.5E+05	nc	2.6E+08	nc

Table 5-2

Site-Specific Cleanup Goals for Sub-Slab and Soil Vapor

Former Kast Property

CAS Number		Odor-Based SSCG[1] (µg/m³)	Sub-Slab and Soil Vapor		Soil Vapor	
			Onsite Resident		Construction and Utility Maintenance Worker	
			SSCG (µg/m³)	Basis	SSCG (µg/m³)	Basis
127-18-4	Tetrachloroethene	1.6E+07	2.1E+02	c	6.6E+06	c
109-99-9	Tetrahydrofuran	--	1.0E+06	nc	4.9E+08	nc
108-88-3	Toluene	1.5E+07	2.6E+06	nc	3.7E+09	nc
79-01-6	Trichloroethene	6.8E+08	2.2E+02	c	2.0E+06	nc
75-01-4	Vinyl chloride	3.9E+08	1.6E+01	c	8.3E+05	c
1330-20-7	Xylene, total	2.2E+05	5.2E+04	nc	5.9E+07	nc
	TPH					
	Aliphatic: C5-C8	--	3.7E+05	nc	1.2E+09	nc
	Aliphatic: C9-C18	--	1.6E+05	nc	1.2E+08	nc
	Aliphatic: C19-C32	--	--	--	--	--
	Aromatic: C6-C8	--	--	--	--	--
	Aromatic: C9-C16	--	2.6E+04	nc	6.7E+06	nc
	Aromatic: C17-C32	--	--	--	--	--
	TPHg	5.0E+04	7.2E+04	nc	2.2E+07	nc
	TPHd	5.0E+05	8.1E+04	nc	2.3E+07	nc
	TPHmo	--	--	--	--	--

Notes:

" -- " not applicable or not available

[1] Odor-based SSCGs for soil vapor based on SFRWCQB ESLs (SFRWCQB, 2013) as directed by RWQCB (RWQCB, 2014b,e).

nc = SSCG based on noncancer effects

c = SSCG based on cancer effects

Table 5-3
Site-Specific Cleanup Goals for Groundwater
Former Kast Property

CAS Number	Constituents of Concern	Primary MCL (µg/L)	Secondary MCL, NL or ESL (µg/L)	Selected Groundwater $SSCG_{GW}$
	Inorganics			
7440-36-0	Antimony	6.0E+00	--	Bkgd
7440-38-2	Arsenic	1.0E+01	--	Bkgd
7440-28-0	Thallium	2.0E+00	--	Bkgd
	PAHs			
91-20-3	Naphthalene	--	1.7E+01	1.7E+01
	TPH			
	TPHg	--	4.1E+02	1.0E+02*
	TPHd	--	2.0E+02	1.0E+02*
	TPHmo	--	6.2E+03	1.0E+02*
	VOCs			
75-34-3	1,1-Dichloroethane	5.0E+00	--	5.0E+00
75-35-4	1,1-Dichloroethene	6.0E+00	--	6.0E+00
96-18-4	1,2,3-Trichloropropane	--	5.0E-03	5.0E-03
107-06-2	1,2-Dichloroethane	5.0E-01	--	5.0E-01
156-59-2	cis-1,2-Dichloroethene	6.0E+00	--	6.0E+00
71-43-2	Benzene	1.0E+00	--	1.0E+00
75-65-0	tert-Butyl Alcohol (TBA)	--	1.2E+01	1.2E+01
127-18-4	Tetrachloroethene	5.0E+00	--	5.0E+00
156-60-5	trans-1,2-Dichloroethene	1.0E+01	--	1.0E+01
79-01-6	Trichloroethene	5.0E+00	--	5.0E+00
75-01-4	Vinyl Chloride	5.0E-01	--	5.0E-01
106-46-7	1,4-Dichlorobenzene	5.0E+00	--	5.0E+00

Notes:

" -- " not available

µg/L: micrograms per liter

Bkgd = background

MCL = State of Maximum Contaminant Level for drinking water

NL = Notification Level

ESL = Environmental Screening Levels, San Francisco RWQCB, Region 2 (SFRWCQB, 2013)

GW = groundwater; SSCG = Site-Specific Cleanup Goal

* Secondary taste and odor threshold for TPH from a Compilation of Water Quality Goals, 16th Edition, April 2011 (SWRCB, 2011)

Table 6-1
Property Addresses for Consideration in Remedial Planning
Former Kast Property

Address	Shallow Excavation	SVE/Bioventing		Targeted Excavation for >5 to ≤10 ft bgs Depth Interval			Sub-Slab Soil Vapor Mitigation
	Exceeds HH Criteria or Leaching to GW SSCGs < 5 ft bgs	Exceeds HH Criteria or Leaching to GW SSCGs >5 to ≤10 ft bgs	Exceeds in either ≤ 5ft or >5 to ≤10 ft bgs depth interval	Front Yard	Back Yard	Both Yards	Identified in HHRA based on > 1 E-6 Risk Level
24401 MARBELLA AVE							
24402 NEPTUNE AVE	X	X	X		X		
24402 PANAMA AVE	X		X				
24402 RAVENNA AVE	X	X	X		X		
24403 NEPTUNE AVE	X	X	X	X	X	X	
24403 RAVENNA AVE		X	X				
24405 MARBELLA AVE							
24406 MARBELLA AVE	X	X	X		X		
24406 NEPTUNE AVE		X	X				X
24406 PANAMA AVE	X		X				
24406 RAVENNA AVE	X	X	X				
24409 NEPTUNE AVE	X	X	X	X	X	X	
24409 RAVENNA AVE		X	X				
24410 PANAMA AVE							
24411 MARBELLA AVE	X		X				
24411 PANAMA AVE	X	X	X		X		
24412 MARBELLA AVE	X	X	X	X	X	X	X
24412 RAVENNA AVE	X	X	X				
24413 NEPTUNE AVE	X	X	X	X	X	X	
24413 RAVENNA AVE		X	X				
24416 MARBELLA AVE	X	X	X	X	X	X	
24416 NEPTUNE AVE	X		X				
24416 PANAMA AVE							
24416 RAVENNA AVE	X	X	X				X
24417 MARBELLA AVE							
24417 PANAMA AVE		X	X				
24419 NEPTUNE AVE	X	X	X	X	X	X	
24419 RAVENNA AVE		X	X				
24420 PANAMA AVE	X		X				
24421 PANAMA AVE	X	X	X	X			
24422 MARBELLA AVE	X	X	X				
24422 NEPTUNE AVE		X	X				
24422 RAVENNA AVE	X	X	X				
24423 MARBELLA AVE							
24423 NEPTUNE AVE	X	X	X	X	X	X	X
24423 RAVENNA AVE	X	X	X				
24426 MARBELLA AVE	X	X	X	X	X	X	
24426 NEPTUNE AVE		X	X				
24426 PANAMA AVE	X		X				
24426 RAVENNA AVE	X		X		X		
24427 MARBELLA AVE							
24427 PANAMA AVE		X	X				
24429 NEPTUNE AVE	X	X	X	X	X	X	X
24429 RAVENNA AVE	X	X	X				
24430 PANAMA AVE							
24431 PANAMA AVE	X	X	X				
24432 MARBELLA AVE	X	X	X		X		
24433 MARBELLA AVE	X		X				X

Table 6-1
Property Addresses for Consideration in Remedial Planning
Former Kast Property

Address	Shallow Excavation	SVE/Bioventing		Targeted Excavation for >5 to ≤10 ft bgs Depth Interval			Sub-Slab Soil Vapor Mitigation
	Exceeds HH Criteria or Leaching to GW SSCGs < 5 ft bgs	Exceeds HH Criteria or Leaching to GW SSCGs >5 to ≤10 ft bgs	Exceeds in either ≤ 5ft or >5 to ≤10 ft bgs depth interval	Front Yard	Back Yard	Both Yards	Identified in HHRA based on > 1 E-6 Risk Level
24436 PANAMA AVE	X		X				
24502 MARBELLA AVE	X	X	X				
24502 NEPTUNE AVE		X	X				
24502 PANAMA AVE							
24502 RAVENNA AVE	X	X	X		X		
24503 MARBELLA AVE							
24503 NEPTUNE AVE	X	X	X	X	X	X	
24503 PANAMA AVE	X	X	X				
24503 RAVENNA AVE		X	X				
24506 MARBELLA AVE	X	X	X	X			X
24507 MARBELLA AVE							
24508 NEPTUNE AVE	X	X	X		X		
24508 PANAMA AVE							X
24508 RAVENNA AVE	X	X	X	X			
24509 NEPTUNE AVE	X	X	X				
24509 PANAMA AVE	X	X	X	X	X	X	
24509 RAVENNA AVE	X	X	X	X			
24512 MARBELLA AVE	X	X	X	X	X	X	
24512 NEPTUNE AVE	X	X	X		X		
24512 PANAMA AVE							
24512 RAVENNA AVE	X	X	X	X			
24513 NEPTUNE AVE		X	X				
24513 PANAMA AVE	X	X	X		X		
24513 RAVENNA AVE		X	X				X
24516 MARBELLA AVE	X	X	X		X		
24517 MARBELLA AVE	X		X				
24518 NEPTUNE AVE	X	X	X	X			
24518 PANAMA AVE							
24518 RAVENNA AVE	X	X	X	X	X	X	
24519 NEPTUNE AVE	X	X	X				
24519 PANAMA AVE	X	X	X		X		
24522 MARBELLA AVE	X	X	X				
24522 NEPTUNE AVE	X	X	X				
24522 PANAMA AVE							
24522 RAVENNA AVE	X	X	X				
24523 MARBELLA AVE							
24523 NEPTUNE AVE	X	X	X		X		
24523 RAVENNA AVE	X	X	X	X			
24526 MARBELLA AVE	X	X	X		X		
24528 NEPTUNE AVE	X	X	X				
24528 PANAMA AVE							
24529 NEPTUNE AVE	X	X	X		X		
24529 PANAMA AVE							
24529 RAVENNA AVE	X	X	X				
24532 MARBELLA AVE	X	X	X		X		
24532 NEPTUNE AVE							
24532 PANAMA AVE	X	X	X				
24532 RAVENNA AVE							

Table 6-1
Property Addresses for Consideration in Remedial Planning
Former Kast Property

Address	Shallow Excavation	SVE/Bioventing		Targeted Excavation for >5 to ≤10 ft bgs Depth Interval			Sub-Slab Soil Vapor Mitigation
	Exceeds HH Criteria or Leaching to GW SSCGs < 5 ft bgs	Exceeds HH Criteria or Leaching to GW SSCGs >5 to ≤10 ft bgs	Exceeds in either ≤ 5ft or >5 to ≤10 ft bgs depth interval	Front Yard	Back Yard	Both Yards	Identified in HHRA based on > 1 E-6 Risk Level
24533 MARBELLA AVE							
24533 PANAMA AVE	X		X				
24533 RAVENNA AVE							
24602 MARBELLA AVE		X	X				
24602 NEPTUNE AVE							
24602 PANAMA AVE		X	X				
24602 RAVENNA AVE							
24603 MARBELLA AVE	X		X				X
24603 NEPTUNE AVE	X	X	X				
24603 PANAMA AVE	X		X				
24603 RAVENNA AVE	X	X	X				
24606 MARBELLA AVE	X	X	X		X		
24607 MARBELLA AVE		X	X				
24608 NEPTUNE AVE	X	X	X				
24608 PANAMA AVE	X	X	X				
24608 RAVENNA AVE	X	X	X				
24609 NEPTUNE AVE	X	X	X	X	X	X	
24609 PANAMA AVE	X	X	X				X
24609 RAVENNA AVE	X		X				
24612 MARBELLA AVE	X	X	X	X	X	X	
24612 NEPTUNE AVE	X	X	X	X	X	X	
24612 PANAMA AVE	X	X	X				
24612 RAVENNA AVE	X		X				
24613 MARBELLA AVE[a]	X						
24613 NEPTUNE AVE	X	X	X	X	X	X	
24613 PANAMA AVE	X	X	X				X
24613 RAVENNA AVE	X	X	X				
24616 MARBELLA AVE	X	X	X	X	X	X	
24617 MARBELLA AVE	X	X	X				
24618 NEPTUNE AVE	X	X	X	X	X	X	
24618 PANAMA AVE	X	X	X				
24618 RAVENNA AVE	X		X				
24619 NEPTUNE AVE	X	X	X	X	X	X	
24619 PANAMA AVE	X	X	X				
24619 RAVENNA AVE		X	X				
24622 MARBELLA AVE	X	X	X	X	X	X	
24622 NEPTUNE AVE	X	X	X	X	X	X	
24623 MARBELLA AVE	X	X	X				X
24623 NEPTUNE AVE	X	X	X	X	X	X	
24627 MARBELLA AVE	X	X	X	X			
24628 MARBELLA AVE	X	X	X		X		
24628 NEPTUNE AVE		X	X				
24629 NEPTUNE AVE	X	X	X	X	X	X	X
24632 NEPTUNE AVE[b]	X	X	X	X	X	X	X
24633 MARBELLA AVE	X		X				
24700 MARBELLA AVE	X	X	X	X			
24700 RAVENNA AVE							
24702 NEPTUNE AVE	X	X	X	X	X	X	

Table 6-1
Property Addresses for Consideration in Remedial Planning
Former Kast Property

Address	Shallow Excavation	SVE/Bioventing		Targeted Excavation for >5 to ≤10 ft bgs Depth Interval			Sub-Slab Soil Vapor Mitigation
	Exceeds HH Criteria or Leaching to GW SSCGs < 5 ft bgs	Exceeds HH Criteria or Leaching to GW SSCGs >5 to ≤10 ft bgs	Exceeds in either ≤ 5ft or >5 to ≤10 ft bgs depth interval	Front Yard	Back Yard	Both Yards	Identified in HHRA based on > 1 E-6 Risk Level
24702 PANAMA AVE	X	X	X				
24703 MARBELLA AVE	X		X				
24703 NEPTUNE AVE	X	X	X	X			
24703 PANAMA AVE	X	X	X				
24703 RAVENNA AVE	X	X	X		X		
24706 MARBELLA AVE	X	X	X	X			
24706 RAVENNA AVE	X		X				
24707 MARBELLA AVE							
24708 PANAMA AVE	X	X	X				
24709 NEPTUNE AVE	X	X	X		X		X
24709 PANAMA AVE	X	X	X		X		
24709 RAVENNA AVE	X	X	X		X		
24710 MARBELLA AVE	X	X	X		X		
24712 NEPTUNE AVE	X	X	X	X	X	X	X
24712 PANAMA AVE	X	X	X				
24712 RAVENNA AVE	X		X				
24713 MARBELLA AVE							
24713 PANAMA AVE	X	X	X				
24713 RAVENNA AVE	X	X	X		X		
24715 NEPTUNE AVE	X	X	X	X	X	X	
24716 MARBELLA AVE	X	X	X				
24716 RAVENNA AVE	X		X				
24717 MARBELLA AVE	X		X				
24718 NEPTUNE AVE	X	X	X	X			
24718 PANAMA AVE	X	X	X				
24719 NEPTUNE AVE	X	X	X	X			
24719 PANAMA AVE	X	X	X				
24719 RAVENNA AVE	X	X	X		X		
24722 MARBELLA AVE	X		X				
24722 NEPTUNE AVE							X
24722 PANAMA AVE	X		X				
24722 RAVENNA AVE	X		X				
24723 MARBELLA AVE	X		X				X
24723 RAVENNA AVE	X	X	X				
24725 NEPTUNE AVE							
24726 MARBELLA AVE							
24726 RAVENNA AVE	X		X				
24727 MARBELLA AVE	X		X				
24728 NEPTUNE AVE	X	X	X				
24728 PANAMA AVE	X	X	X				
24729 NEPTUNE AVE	X		X				
24729 PANAMA AVE							
24729 RAVENNA AVE							
24732 MARBELLA AVE	X		X				
24732 NEPTUNE AVE	X	X	X		X		
24732 PANAMA AVE							
24732 RAVENNA AVE	X		X				
24733 MARBELLA AVE	X		X				

Table 6-1
Property Addresses for Consideration in Remedial Planning
Former Kast Property

Address	Shallow Excavation	SVE/Bioventing		Targeted Excavation for >5 to ≤10 ft bgs Depth Interval			Sub-Slab Soil Vapor Mitigation
	Exceeds HH Criteria or Leaching to GW SSCGs < 5 ft bgs	Exceeds HH Criteria or Leaching to GW SSCGs >5 to ≤10 ft bgs	Exceeds in either ≤ 5ft or >5 to ≤10 ft bgs depth interval	Front Yard	Back Yard	Both Yards	Identified in HHRA based on > 1 E-6 Risk Level
24733 PANAMA AVE	X		X				
24733 RAVENNA AVE	X	X	X				
24735 NEPTUNE AVE	X		X				
24736 MARBELLA AVE							
24736 RAVENNA AVE	X	X	X	X			
24737 MARBELLA AVE	X	X	X				
24738 NEPTUNE AVE	X	X	X	X	X	X	X
24738 PANAMA AVE	X		X				
24739 NEPTUNE AVE	X		X				
24739 PANAMA AVE	X	X	X				
24739 RAVENNA AVE	X	X	X	X	X	X	
24740 MARBELLA AVE	X		X				
24741 MARBELLA AVE							X
24743 RAVENNA AVE	X	X	X	X	X	X	
24744 MARBELLA AVE	X		X				X
24748 RAVENNA AVE	X	X	X				
24749 RAVENNA AVE	X	X	X		X		X
24752 RAVENNA AVE	X	X	X				
24802 PANAMA AVE	X		X				
24803 NEPTUNE AVE	X		X				
24803 PANAMA AVE	X	X	X				
24808 PANAMA AVE	X		X				
24809 NEPTUNE AVE	X	X	X				
24809 PANAMA AVE	X	X	X	X	X	X	
24812 PANAMA AVE	X		X				
24813 PANAMA AVE	X	X	X				
24815 NEPTUNE AVE	X	X	X				
24818 PANAMA AVE	X		X				
24819 PANAMA AVE	X	X	X		X		
24822 PANAMA AVE	X	X	X				
24823 PANAMA AVE	X	X	X	X			
24825 NEPTUNE AVE							
24828 PANAMA AVE	X	X	X				
24829 PANAMA AVE	X	X	X				
24832 PANAMA AVE	X	X	X				
24833 PANAMA AVE	X	X	X				
24838 PANAMA AVE	X		X				
24904 NEPTUNE AVE		X	X				
24912 NEPTUNE AVE		X	X				
301 244TH ST							
305 244TH ST	X	X	X				
311 244TH ST	X	X	X				
317 244TH ST	X		X				X
321 244TH ST[a]	X						
327 244TH ST							
331 244TH ST[a]	X						
337 244TH ST							
341 244TH ST							

Table 6-1
Property Addresses for Consideration in Remedial Planning
Former Kast Property

Address	Shallow Excavation	SVE/Bioventing		Targeted Excavation for >5 to ≤10 ft bgs Depth Interval			Sub-Slab Soil Vapor Mitigation
	Exceeds HH Criteria or Leaching to GW SSCGs < 5 ft bgs	Exceeds HH Criteria or Leaching to GW SSCGs >5 to ≤10 ft bgs	Exceeds in either ≤ 5ft or >5 to ≤10 ft bgs depth interval	Front Yard	Back Yard	Both Yards	Identified in HHRA based on > 1 E-6 Risk Level
344 249TH ST	X		X				
345 249TH ST	X	X	X				
347 244TH ST							
348 248TH ST	X	X	X	X			X
348 249TH ST	X	X	X				
351 244TH ST	X		X				
352 249TH ST		X	X				X
353 249TH ST	X	X	X				
354 248TH ST	X	X	X	X	X	X	
357 244TH ST							
357 249TH ST		X	X				
358 249TH ST	X		X				
360 248TH ST	X	X	X	X			
361 244TH ST							
362 249TH ST							
363 249TH ST	X	X	X	X			
364 248TH ST	X	X	X				
367 244TH ST	X		X				
367 249TH ST	X	X	X				
368 249TH ST	X	X	X				
373 249TH ST	X	X	X	X			
374 248TH ST	X	X	X		X		
374 249TH ST	X	X	X				
377 244TH ST							
377 249TH ST	X	X	X	X			
378 249TH ST	X	X	X				X
383 249TH ST	X	X	X				X
402 249TH ST	X		X				
408 249TH ST							
412 249TH ST	X	X	X				

[a] = Property exceeds SSCGs in the > 5 to ≤10 feet bgs interval, but only for metals above background, therefore no SVE/bioventing is proposed.

[b] = Property not identified in HHRA based on > 1 E-6 risk level, but slightly exceeds RAO for methane.

GW = groundwater

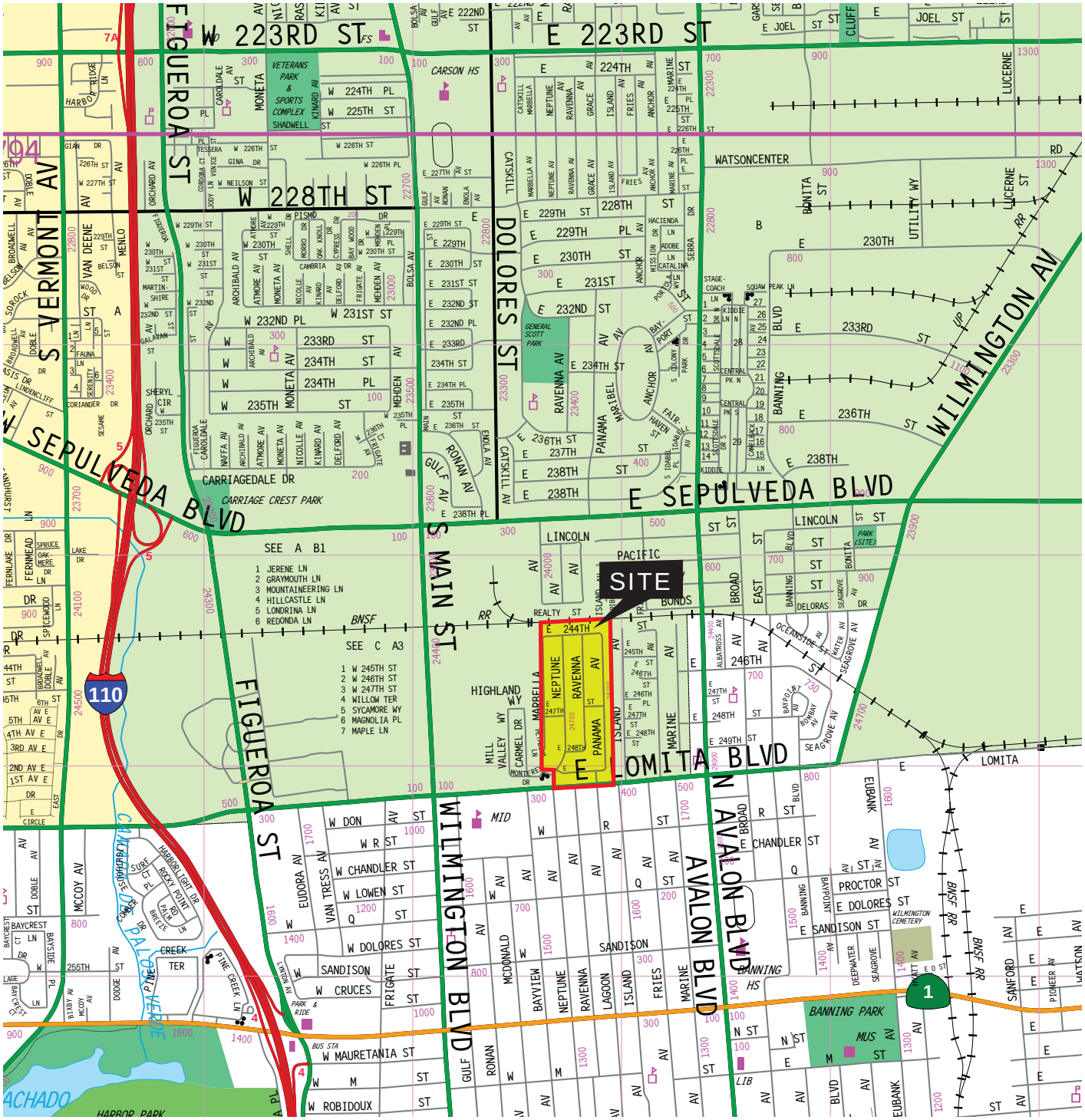
HH = Human Health

RA = Risk Assessment

SSCG = Site-Specific Cleanup Goal

SVE = Soil Vapor Extraction

"X" - Property Selected For Remediation based on results of Human Health Risk Assessment or additional considerations such as targeted mass removal (excavation at some properties > 5 to ≤10 feet bgs) or risk management considerations (subslab depressurization systems)



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0 1400 2800

SCALE IN FEET

SITE VICINITY MAP

Project No.: 49194119	Date: June 2014	Project: Former KAST Property	Figure 2-1

K:/2008/KAST/fiugure 1 Vic Map.ai

URS

0 150 300

SCALE IN FEET

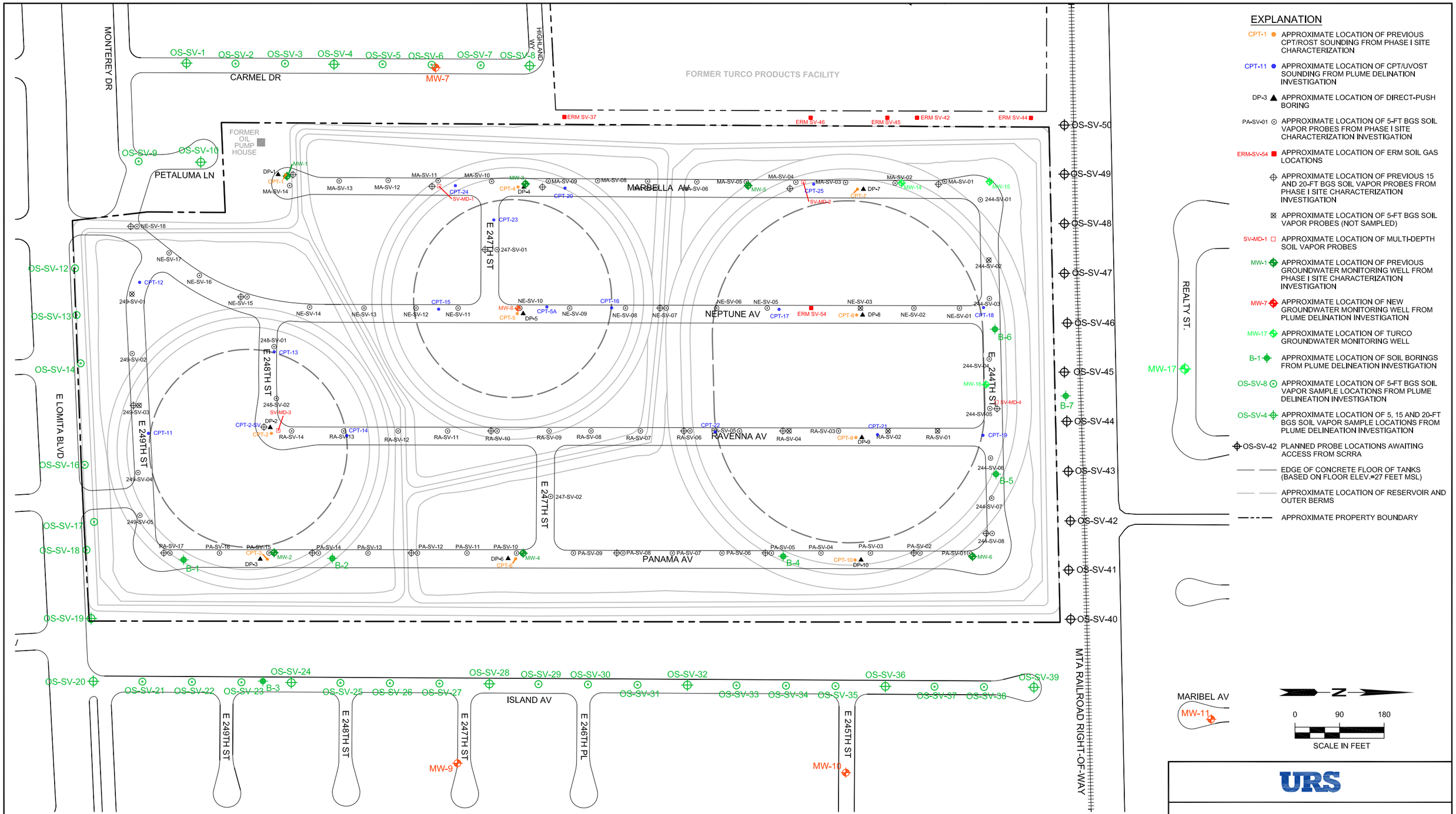
N

URS

LOCATION MAP
SHOWING SITE AND SURROUNDING
PROPERTIES AND FEATURES

Proj. No.: 49194119	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 2-2

G:\1 Shell Products - Former Kast Property\RAP\SVE\Figure 2-2 Location Map Site And Surrounding Props And Features.dwg , File date: 6/30/2014 9:57 AM , Print date: 6/30/2014 10:03 AM by: Volk, Jessica

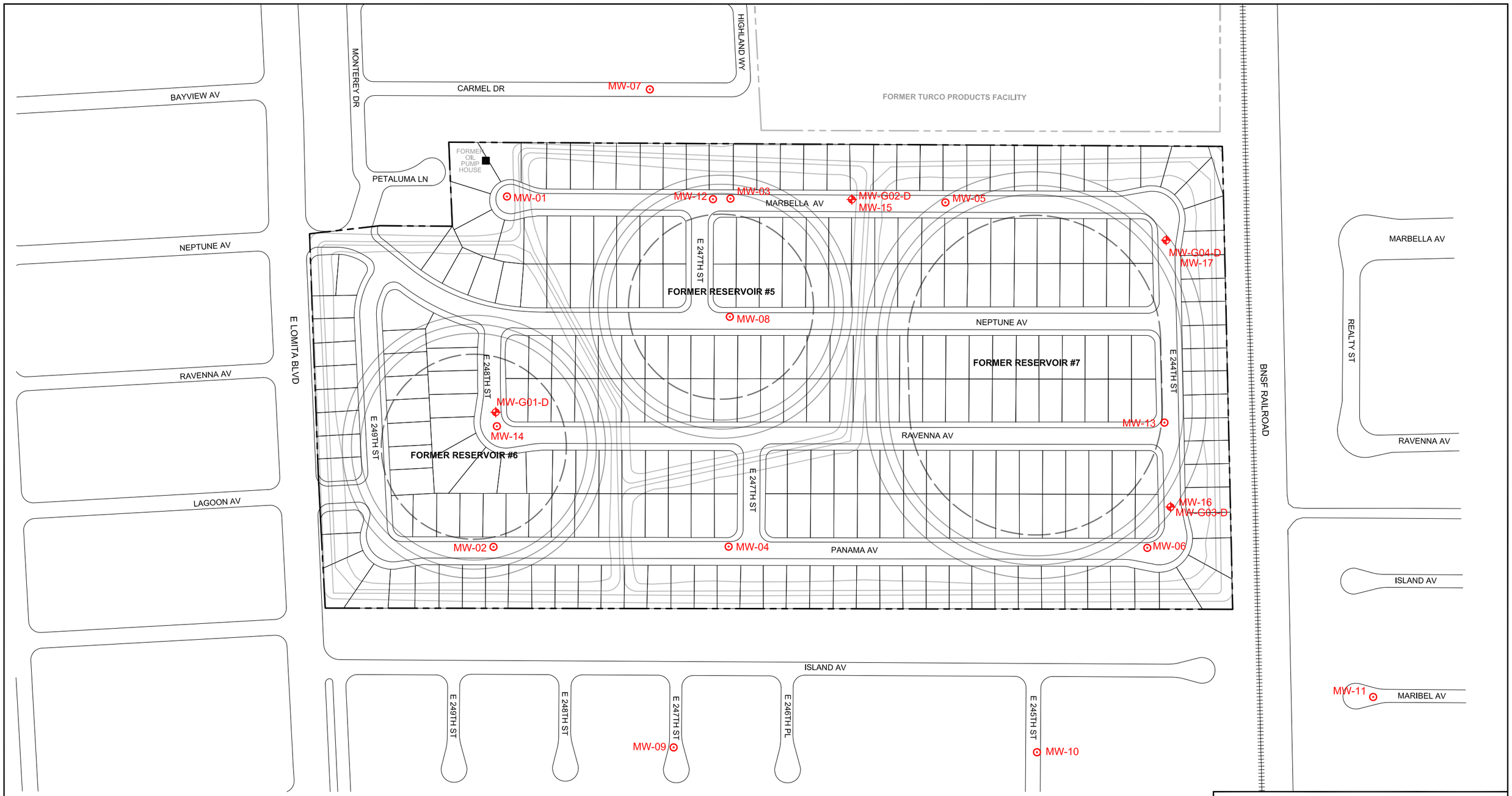


URS

LOCATIONS OF BORINGS AND SOIL VAPOR PROBES

Proj. No.: 49194119	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 3-1

G:\1 Shell Products - Former Kast Property\RAP\SVE\Figure 3-1 Boring And Soil Vapor Probes.dwg , File date: 3/10/2014 10:58 AM, Print date: 6/26/2014 3:42 PM by: Sevilla, Vincent



EXPLANATION

MW-G01-D — APPROXIMATE LOCATION OF KAST GAGE MONITORING WELL

MW-10 — APPROXIMATE LOCATION OF SHALLOW WATER-TABLE MONITORING WELL

— — — — APPROXIMATE SITE BOUNDARY

N

0 100 200

SCALE IN FEET

URS

LOCATIONS OF GROUNDWATER MONITORING WELLS

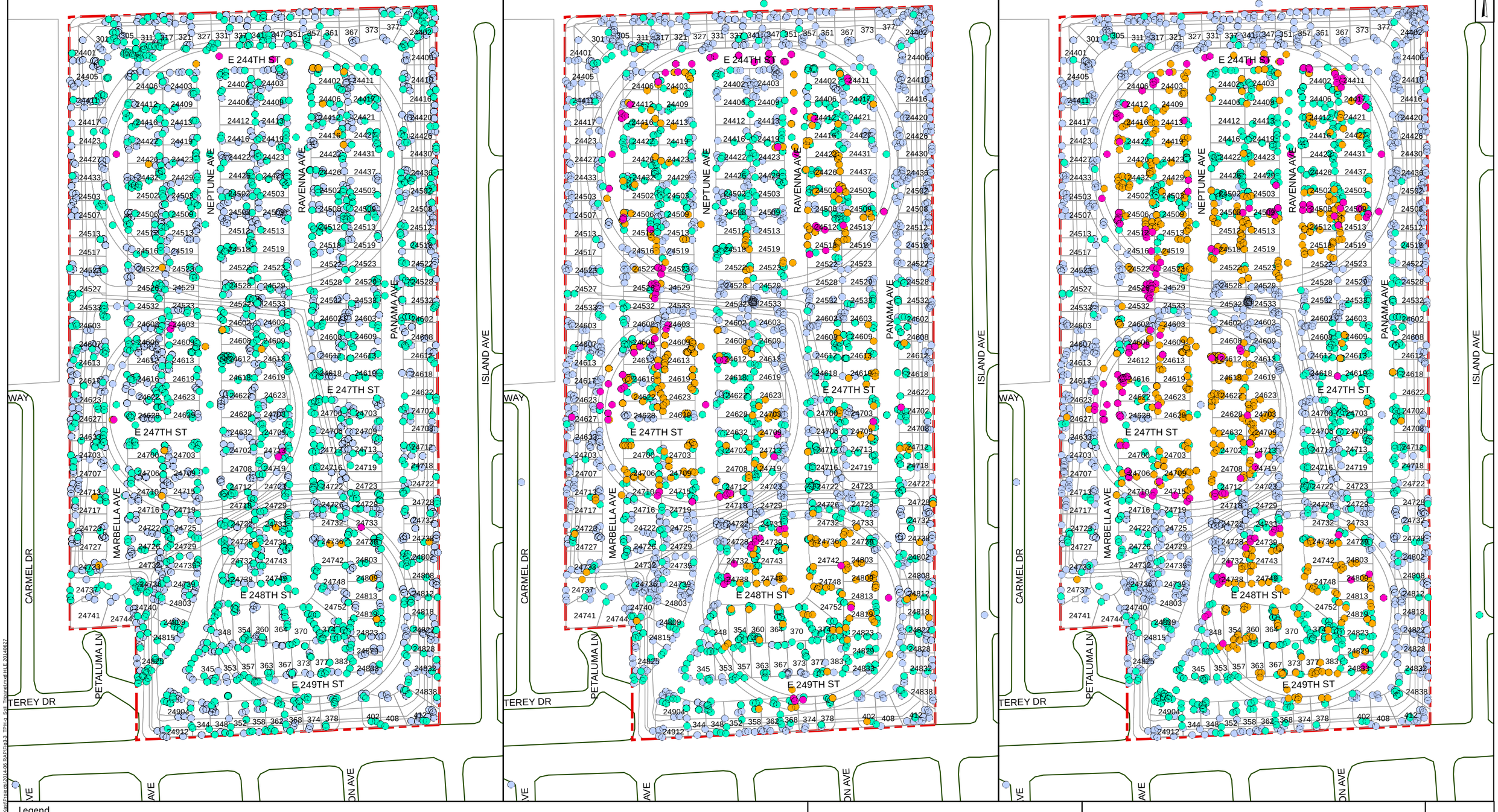
Proj. No.: 49194357	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 3-2

G:\1 Shell Products - Former Kast Property\RAP\SVE\Figure 3-2 MW Locations.dwg , File date: 6/30/2014 7:23 AM, Print date: 6/30/2014 7:23 AM by: Sevilla, Vincent

≤ 2 FT. BGS

> 2 - ≤ 5 FT. BGS

> 5 - ≤ 10 FT. BGS



Legend

- Non-Detect (ND)
- <= 117 mg/kg
- > 117 to 1170 mg/kg
- > 1170 mg/kg

Notes:
117 mg/kg is the soil leaching to groundwater SSCG for TPHg

250 125 0 250 Feet

Geosyntec consultants

Santa Barbara, CA | June 2014

Distribution of TPH-Gasoline in Site Soils

Former Kast Property

Figure **3-3**

Legend

- Non-Detect (ND)
- <= 625 mg/kg
- > 625 to 6250 mg/kg
- > 6250 mg/kg

Notes:
625 mg/kg is the soil leaching to groundwater SSCG for TPHd

250 125 0 250 Feet

Geosyntec consultants

Santa Barbara, CA | June 2014

Distribution of TPH-Diesel in Site Soils

Former Kast Property

Figure

3-4

Legend

- Non-Detect (ND)
- <= 10000 mg/kg
- > 10000 to 100000 mg/kg
- > 100000 mg/kg

Notes:
10000 mg/kg is the soil leaching to groundwater SSCG for TPHmo

250 125 0 250 Feet

Geosyntec consultants

Santa Barbara, CA | June 2014

Distribution of TPH-Motor Oil in Site Soils

Former Kast Property

Figure **3-5**

Legend

- Non-Detect (ND)
- <= 0.021 mg/kg
- > 0.021 to 0.21 mg/kg
- > 0.21 to 2.1 mg/kg
- > 2.1 mg/kg

Notes:
0.021 mg/kg is the soil leaching to groundwater SSCG for Benzene

250 125 0 250 Feet

Geosyntec consultants

Santa Barbara, CA | June 2014

Distribution of Benzene in Site Soils

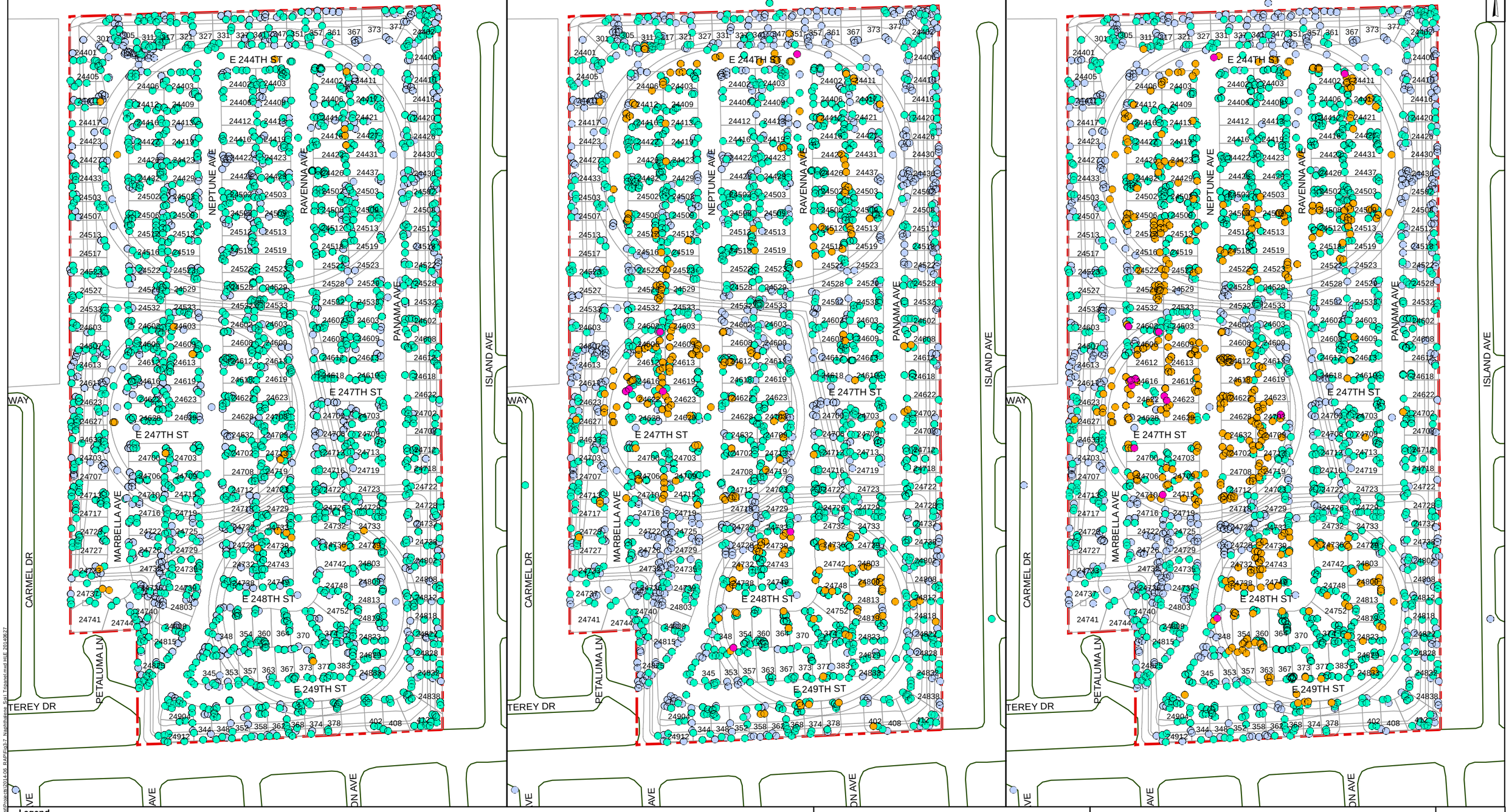
Former Kast Property

Figure **3-6**

≤ 2 FT. BGS

> 2 - ≤ 5 FT. BGS

> 5 - ≤ 10 FT. BGS



Legend

- Non-Detect (ND)
- <= 4.0 mg/kg
- > 4.0 to 40 mg/kg
- > 40 to 400 mg/kg
- > 400 mg/kg

250 125 0 250 Feet

Notes:
4.0 mg/kg is the human health based SSCG for naphthalene

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Santa Barbara, CA | June 2014

Distribution of Naphthalene in Site Soils

Former Kast Property

Figure **3-7**

Legend

- Non-Detect (ND)
- <= 0.9 mg/kg
- > 0.9 to 1.6 mg/kg
- > 1.6 to 16 mg/kg
- > 16 mg/kg

Notes:
0.9 mg/kg is the background SSCG for benzo(a)pyrene-equivalents

250 125 0 250 Feet

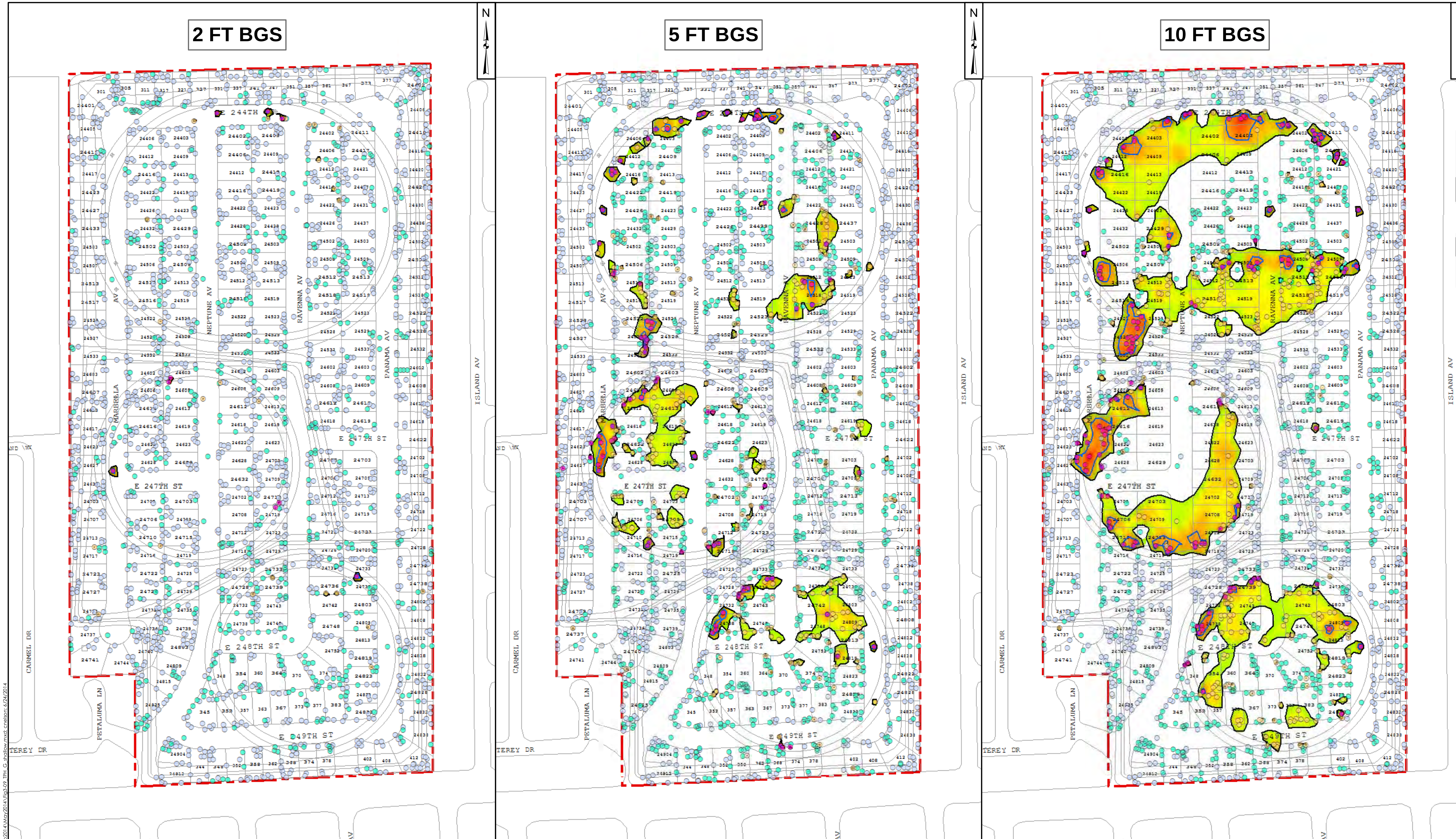
Geosyntec consultants

Santa Barbara, CA | June 2014

Distribution of Benzo(a)pyrene-Equivalents in Site Soils

Former Kast Property

Figure 3-8



TPH as Gasoline
- Non-Detect (ND)
- < 117 mg/kg
- >= 117 to 1,170 mg/kg
- > 1,170 mg/kg

Contour
- 117 mg/kg
- 1,170 mg/kg

TPH as Gasoline in Soil
- 1,000 mg/kg
- 100 mg/kg
- 10 mg/kg
- 1 mg/kg
- 0.1 mg/kg
- 0.02 mg/kg

Note: Contours created in Mining Visualization System (MVS) using Franke/Nielson Inverse Distance Weighting (IDW) interpolation

250 125 0 250 Feet

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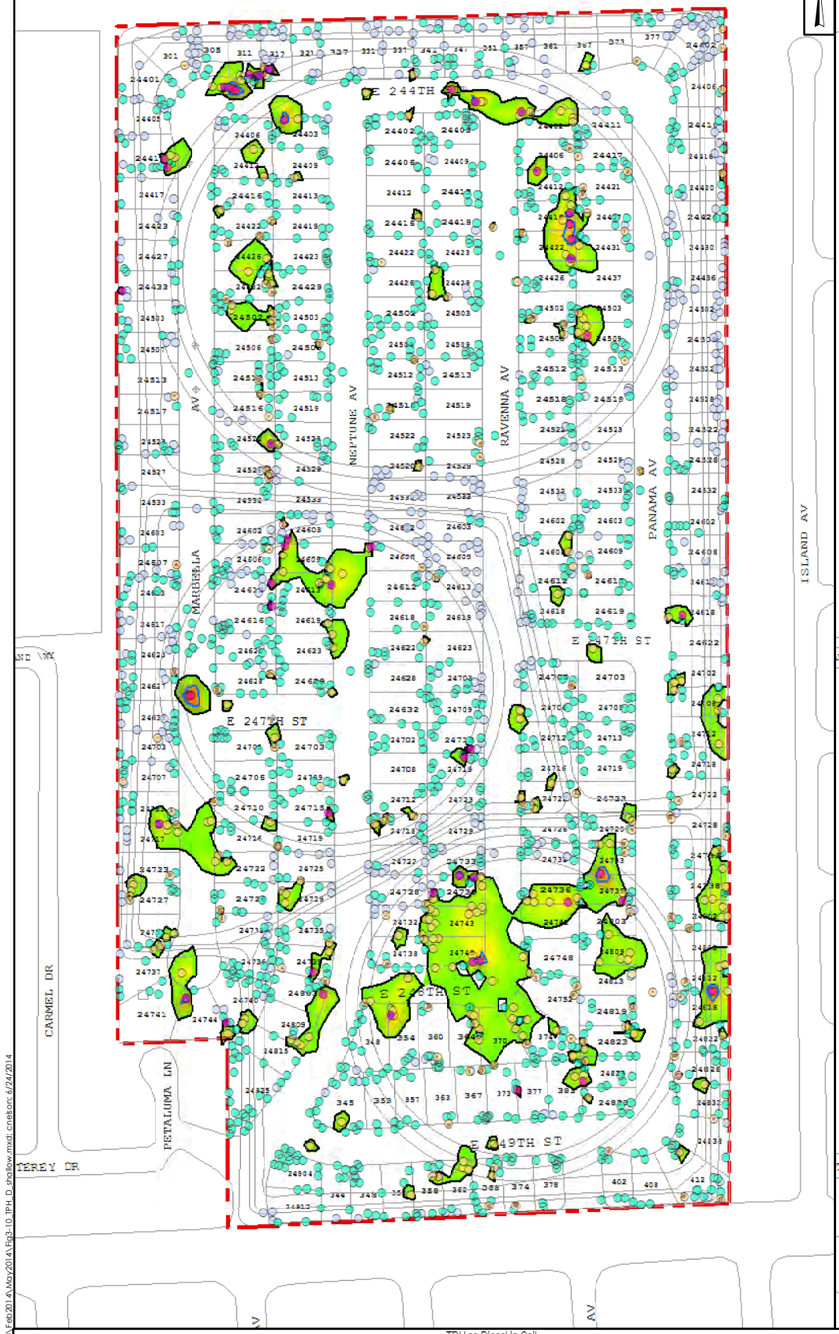
Santa Barbara, CA | 24-Jun-2014

Contours Showing TPHg Distribution in Soil

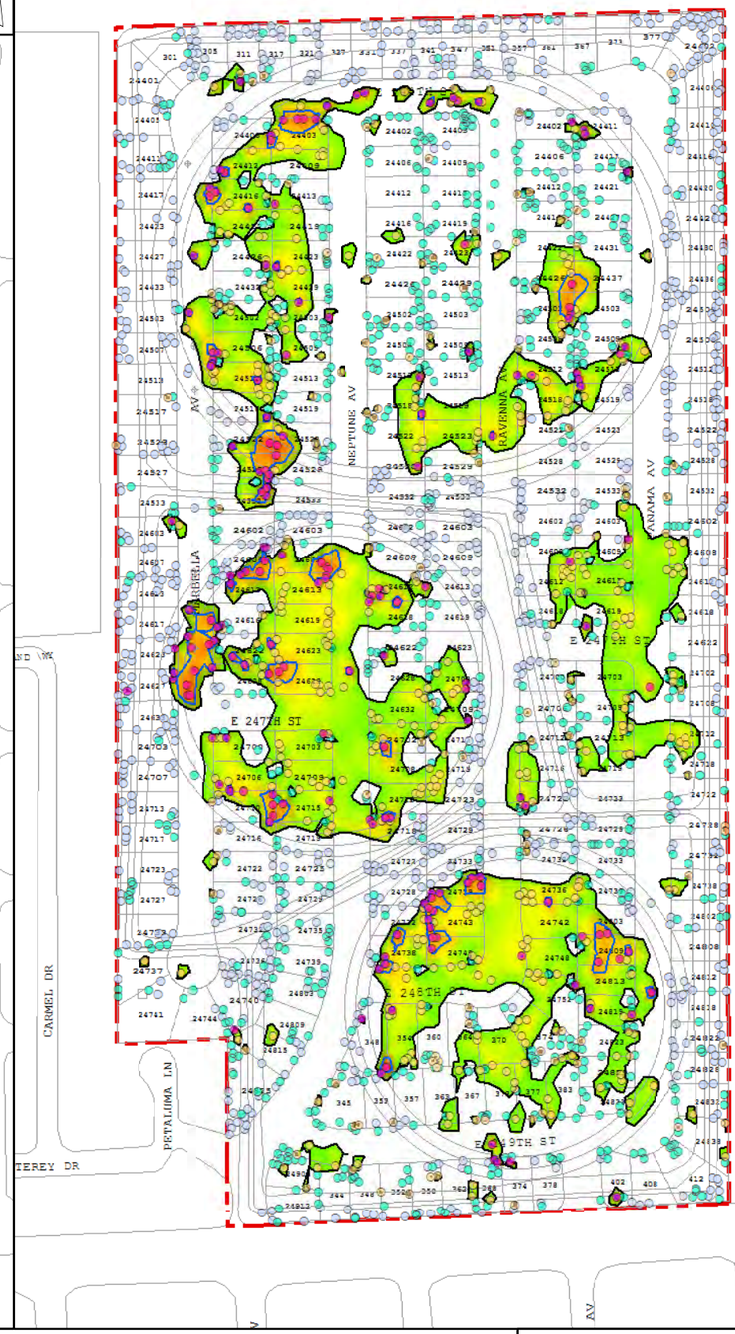
Former Kast Property

Figure **3-9**

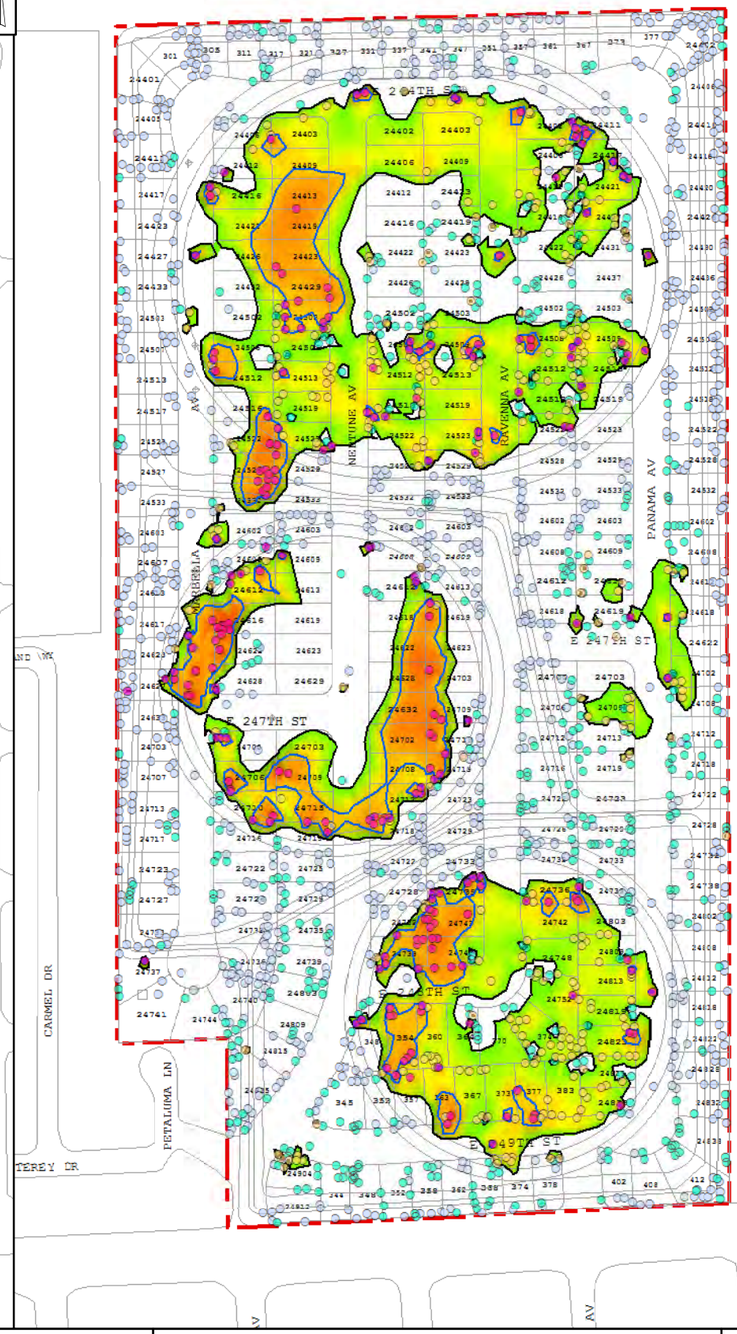
2 FT BGS



5 FT BGS



10 FT BGS



TPH as Diesel
- Non-Detect (ND)
- < 625 mg/kg
- >= 625 to 6,250 mg/kg
- > 6,250 mg/kg

Contour
- 625 mg/kg
- 6,250 mg/kg

TPH as Diesel in Soil
10,000 mg/kg
1,000 mg/kg
100 mg/kg
10 mg/kg
1 mg/kg

Note: Contours created in Mining Visualization System (MVS) using Franke/Nielson Inverse Distance Weighting (IDW) interpolation

250 125 0 250 Feet

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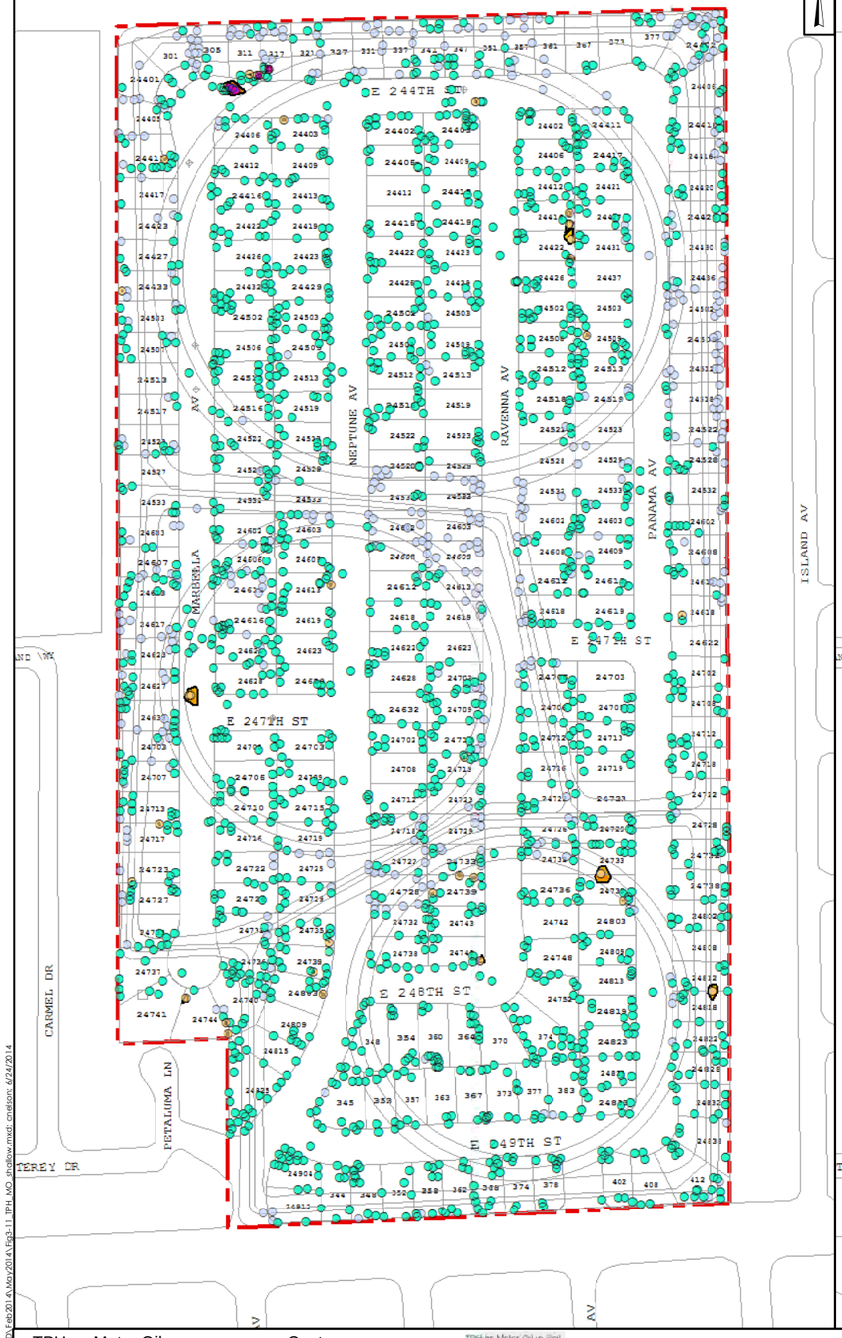
Contours Showing TPHd Distribution in Soil

Former Kast Property

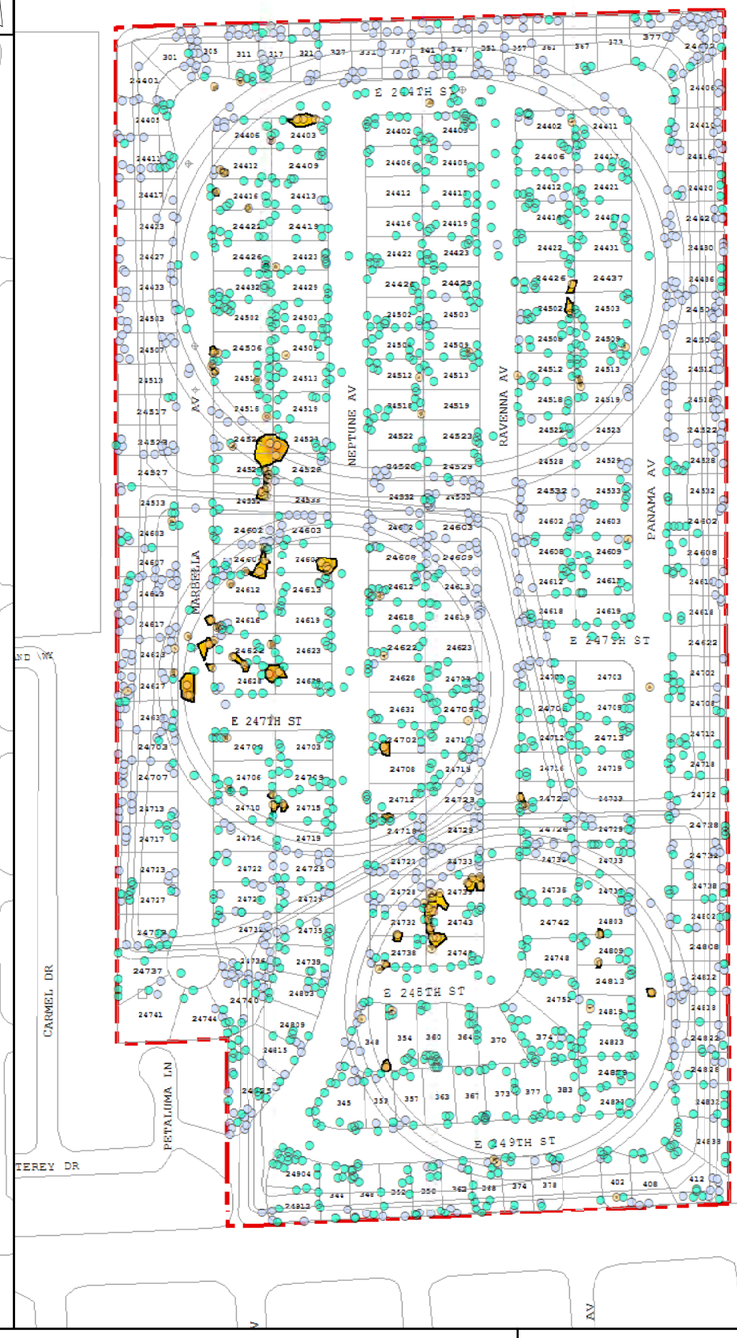
Figure **3-10**

N:\KAST\GIS\KAST\GIS\MXD\Fig3-10_TPH_D_shallow.mxd creation: 6/24/2014

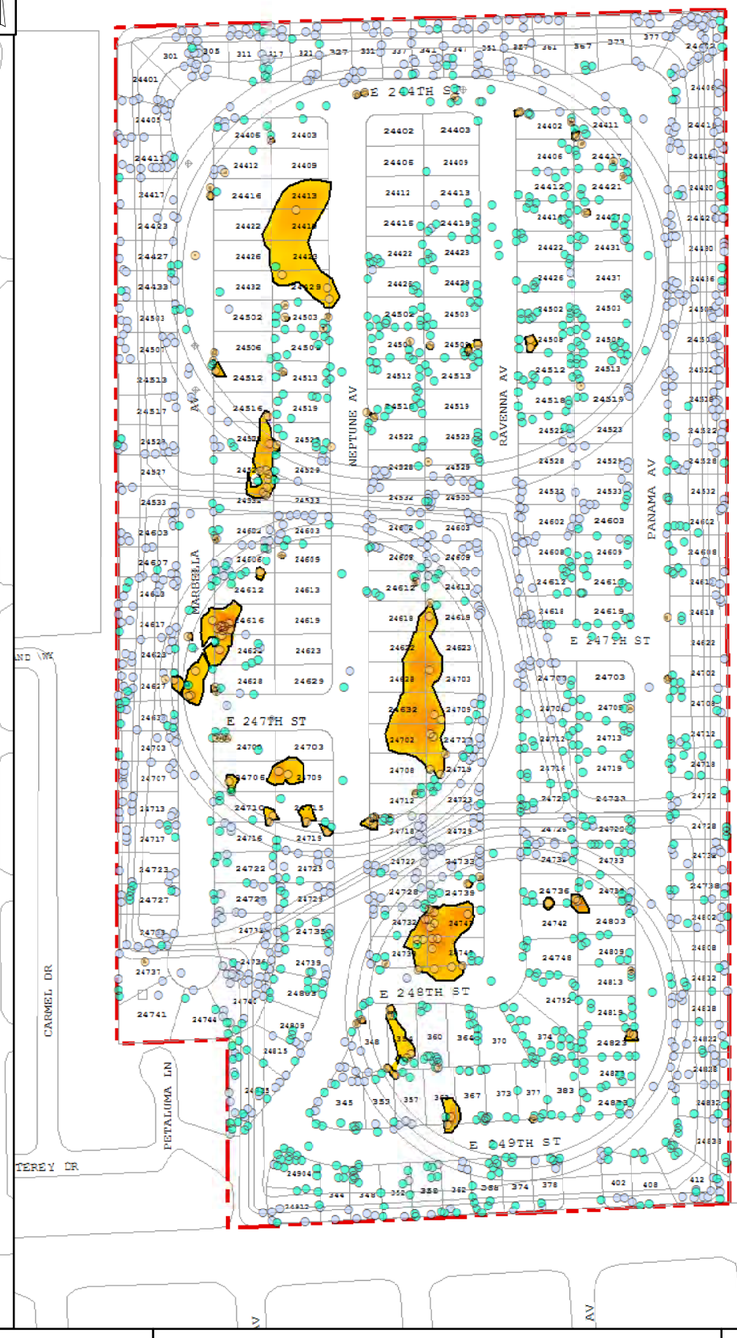
2 FT BGS



5 FT BGS



10 FT BGS



TPH as Moter Oil
- Non-Detect (ND)
- < 10,000 mg/kg
- >= 10,000 to 50,000 mg/kg
- > 50,000 mg/kg

Contour
- 10,000 mg/kg
- 50,000 mg/kg

TPH as Moter Oil in Soil
100,000 mg/kg
10,000 mg/kg
1,000 mg/kg
100 mg/kg
10 mg/kg
3 mg/kg

Note: Contours created in Mining Visualization System (MVS) using Franke/Nielson Inverse Distance Weighting (IDW) interpolation

250 125 0 250 Feet

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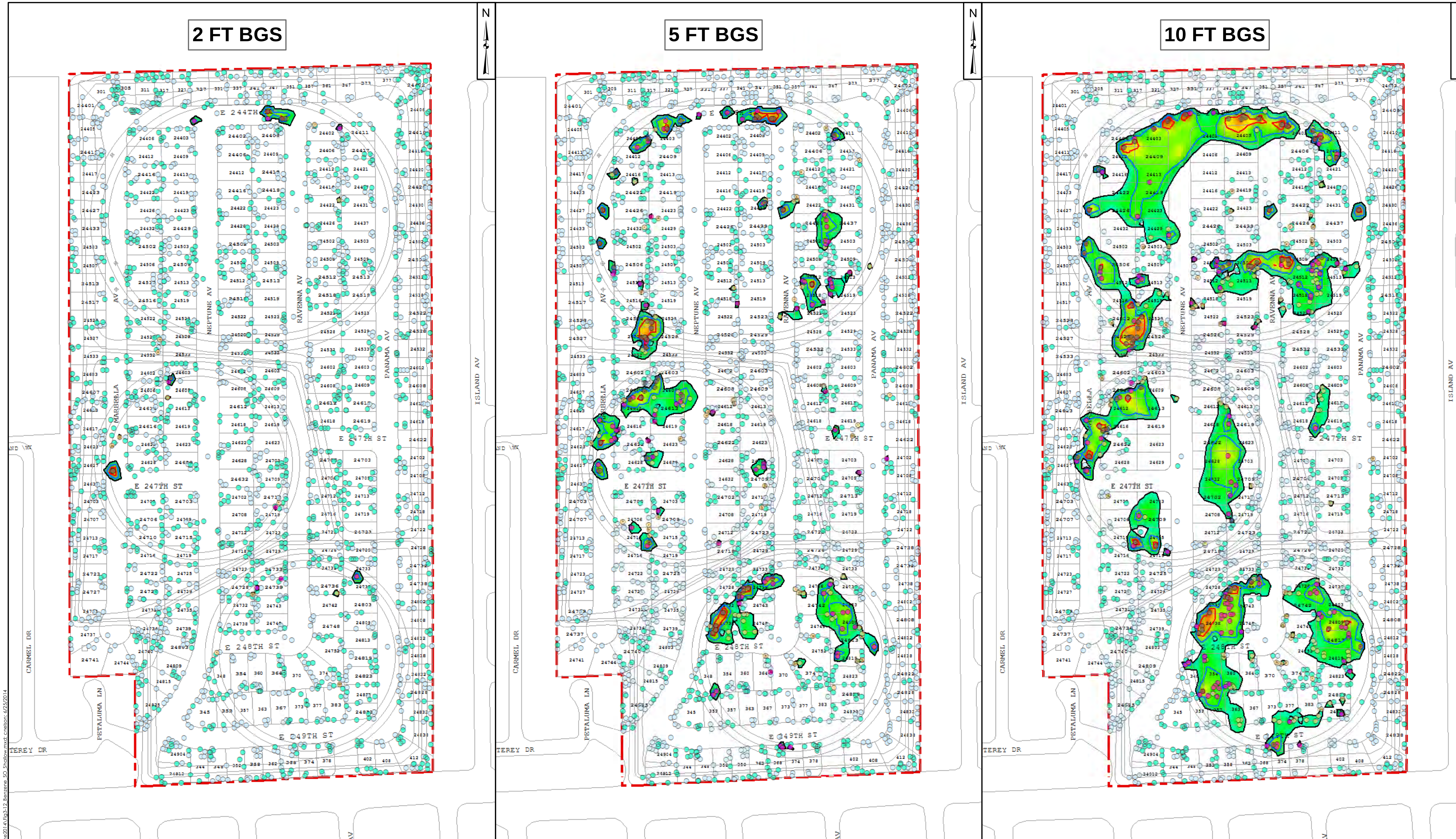
Contours Showing TPHmo Distribution in Soil

Former Kast Property

Figure **3-11**

N:\KAST\GIS\KAST\GIS\MXD\Feb2014\Feb11_TPH_MO_shallow.mxd creation: 6/24/2014



Benzene

- Non-Detect (ND)
- < 0.021 mg/kg
- >= 0.021 to 0.21 mg/kg
- >= 0.21 to 2.1 mg/kg
- > 2.1 mg/kg

Contour

- 0.021 mg/kg
- 0.21 mg/kg
- 2.1 mg/kg

Benzene in Soil: 10 mg/kg, 1 mg/kg, 0.1 mg/kg, 0.01 mg/kg, 0.001 mg/kg

250 125 0 250 Feet

Note: Contours created in Mining Visualization System (MVS) using Franke/Nielson Inverse Distance Weighting (IDW) interpolation

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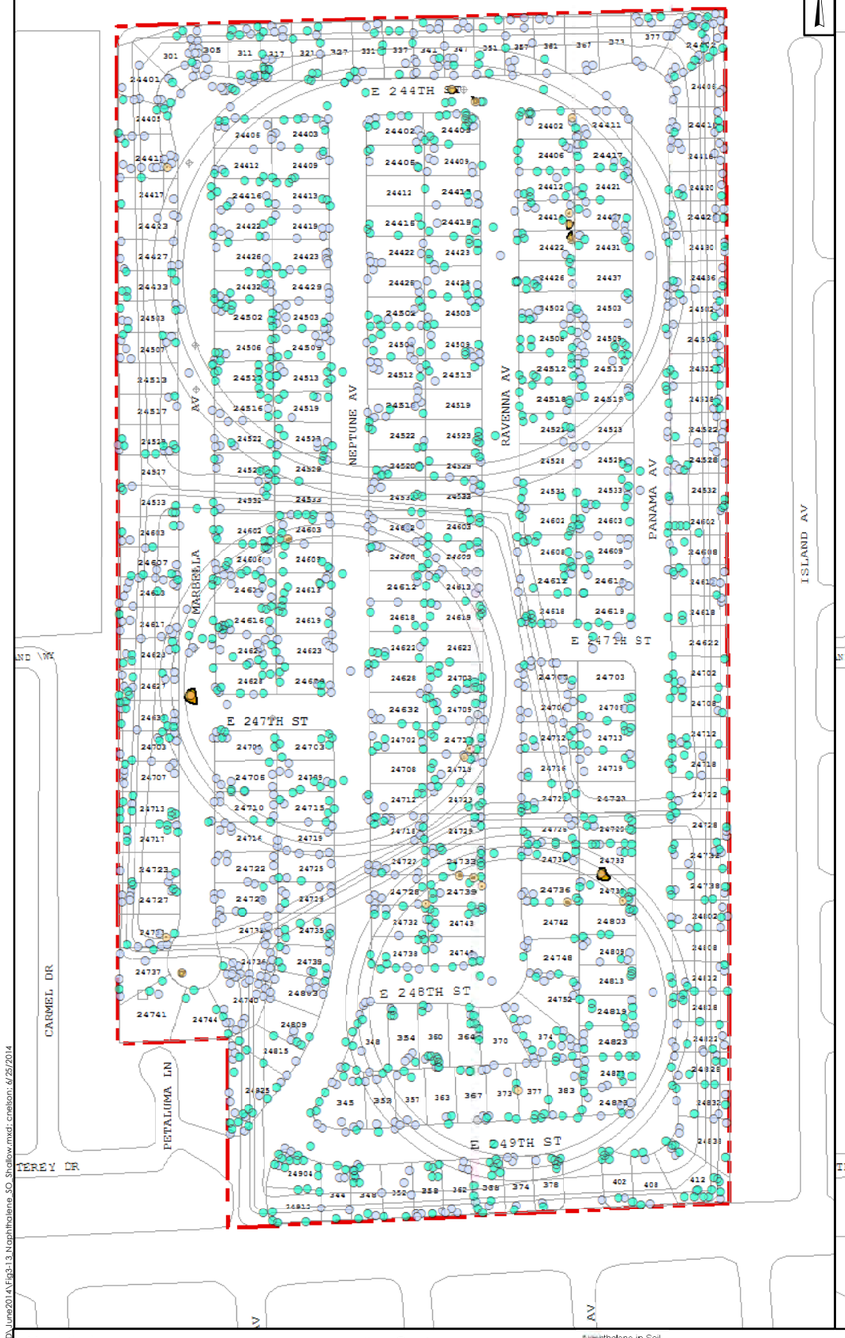
Contours Showing Benzene Distribution in Soil

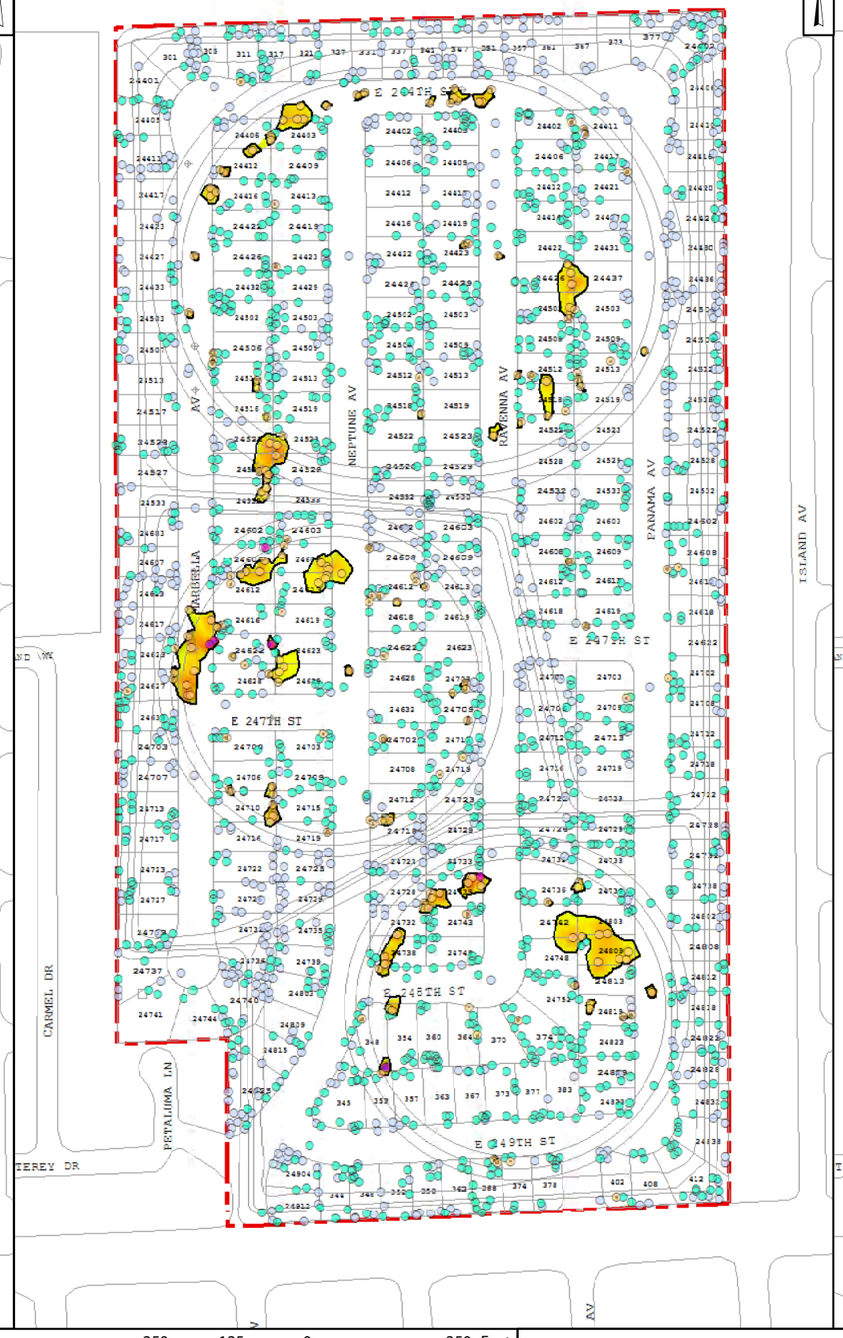
Former Kast Property

Figure **3-12**

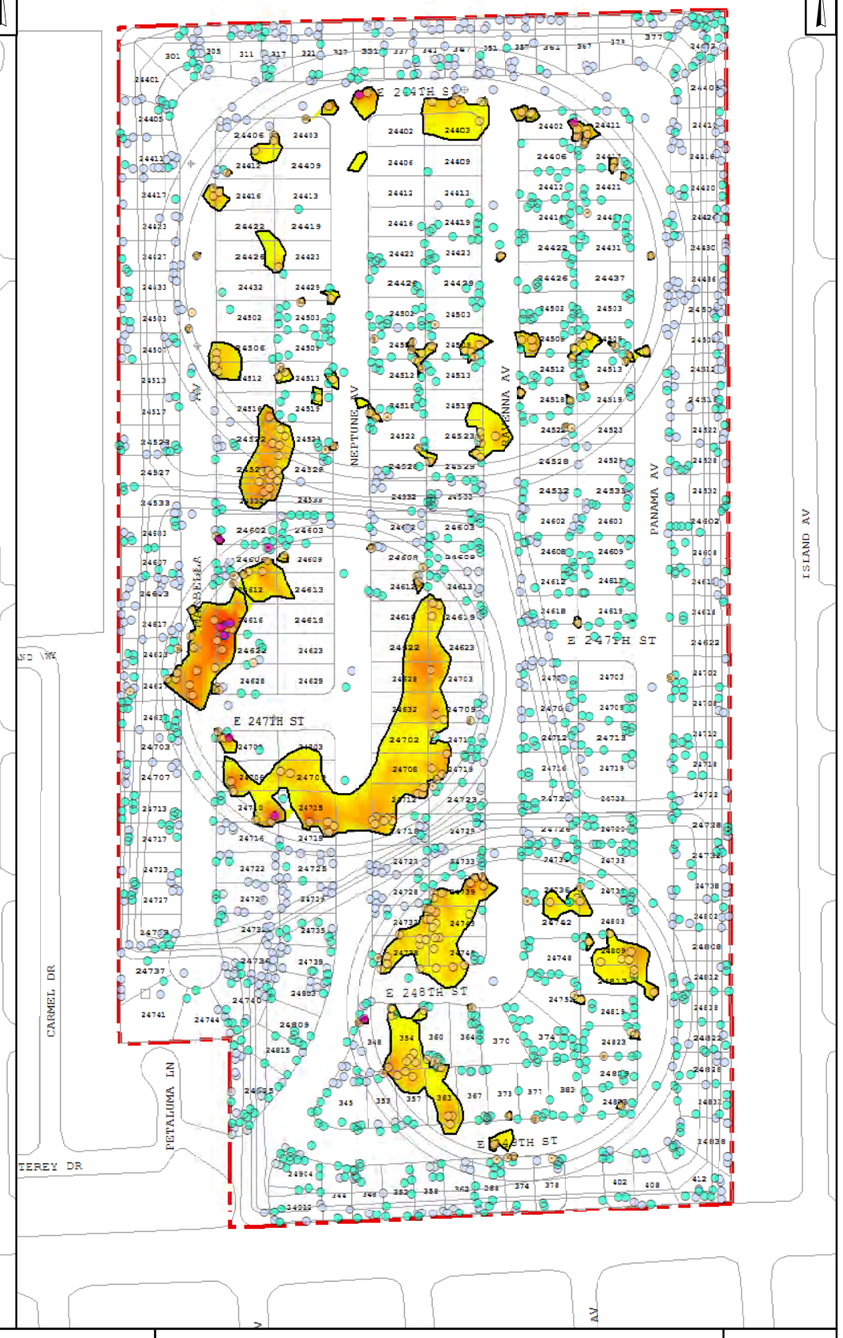
2 FT BGS



5 FT BGS



10 FT BGS



Naphthalene
- Non-Detect (ND)
- < 4.0 mg/kg *
- >= 4.0 to 40 mg/kg
- >= 40 to 400 mg/kg
- > 400 mg/kg

Contour
- 4.0 mg/kg *
- 40 mg/kg
- 400 mg/kg

Naphthalene in Soil
- 10 mg/kg
- 1 mg/kg
- 0.1 mg/kg
- 0.01 mg/kg
- 0.001 mg/kg

250 125 0 250 Feet

Note: Contours created in Mining Visualization System (MVS) using Franke/Nielson Inverse Distance Weighting (IDW) interpolation
* - 4.0 mg/kg is the human health based SSCG

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Contours Showing Naphthalene Distribution in Soil

Former Kast Property

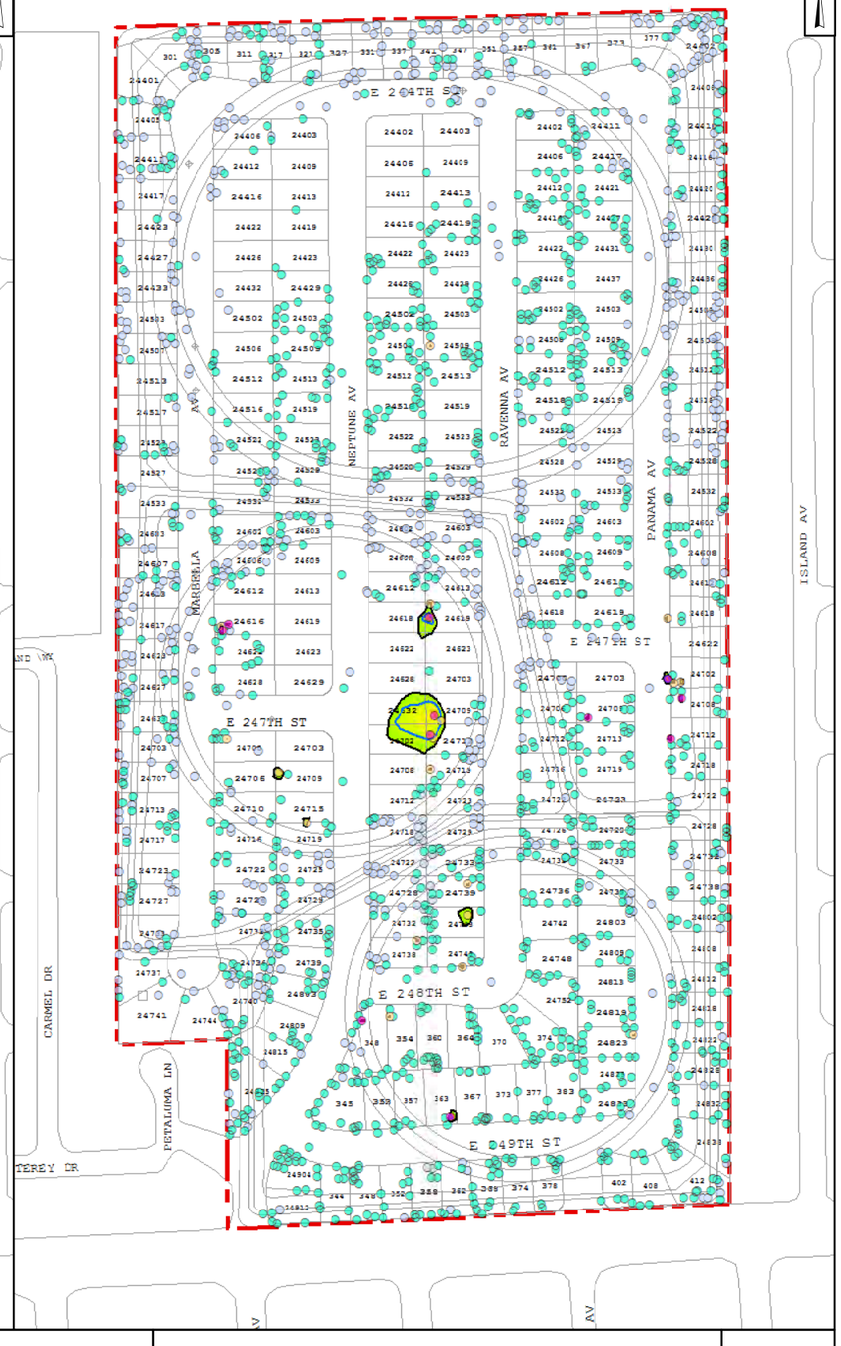
Figure **3-13**

N:\KAST\GIS\KAST\GIS\MXD\ June2014\Fig3-13 Naphthalene_SO_Shallow.mxd creation: 6/25/2014

2 FT BGS

5 FT BGS

10 FT BGS



Benzo(a)pyrene-equivalent Contour

- Non-Detect (ND)
- < 0.9 mg/kg
- >= 0.9 to 1.6 mg/kg
- > 1.6 mg/kg
- 0.9 mg/kg
- 1.6 mg/kg

Benzo(a)pyrene-equivalent in Soil

10 mg/kg
1 mg/kg
0.1 mg/kg
0.01 mg/kg
0.001 mg/kg

250 125 0 250 Feet

Note: Contours created in Mining Visualization System (MVS) using Franke/Nielson Inverse Distance Weighting (IDW) interpolation

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Contours Showing Benzo(a)pyrene-Equivalents Distribution in Soil

Former Kast Property

Figure **3-14**

Sub-Slab

5 FT. BGS

15 FT. BGS

N

E 244TH ST
E 247TH ST
E 248TH ST
E 249TH ST
NEPTUNE AVE
RAVENNA AVE
PANAMA AVE
ISLAND AVE
MARBELLA AVE
CARMEL DR
PETALUMA LN
TEREY DR

Legend

- Non-Detect (ND)
- <= 0.1 %
- > 0.1 to 0.5 %
- > 0.5 to 5.0 %
- > 5.0 %

Notes:
Results for methane due to leaking natural gas line or sewer line sources are not shown
0.1% and 0.5% are the SSCGs for methane in soil vapor

250 125 0 250 Feet

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Methane Concentrations Detected in Sub-slab Soil Vapor and in Soil Vapor at 5 and 15 feet bgs

Former Kast Property

Figure **3-15**

Sub-Slab

5 FT. BGS

15 FT. BGS

N

E 244TH ST
E 247TH ST
E 248TH ST
E 249TH ST
NEPTUNE AVE
RAVENNA AVE
PANAMA AVE
ISLAND AVE
MARBELLA AVE
CARMEL DR
PETALUMA LN
TEREY DR

Legend

- Non-Detect (ND)
- <= 42 ug/m³
- > 42 to 420 ug/m³
- > 420 to 4200 ug/m³
- > 4200 ug/m³

Notes:
42 µg/m³ is the SSCG for benzene in soil vapor

250 125 0 250 Feet

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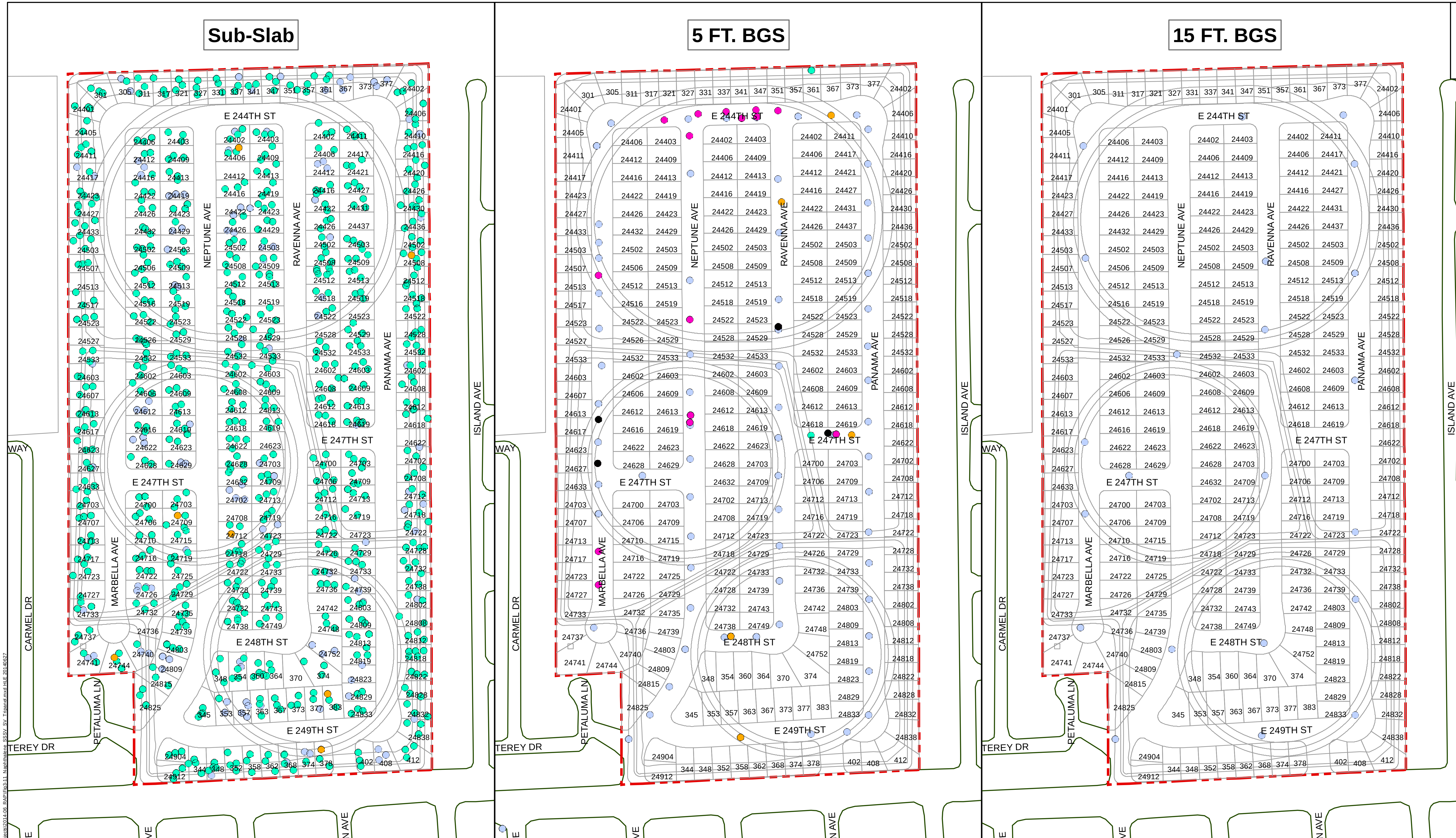
Benzene Concentrations in Sub-slab Soil Vapor and in Soil Vapor at 5 and 15 feet bgs

Former Kast Property

Figure **3-16**



Legend

- Non-Detect (ND)
- <= 36 ug/m³
- > 36 to 360 ug/m³
- > 360 to 3600 ug/m³
- > 3600 ug/m³

Notes:
36 µg/m³ is the SSCG for naphthalene in soil vapor

250 125 0 250 Feet

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Naphthalene Concentrations in Sub-slab Soil Vapor and in Soil Vapor at 5 and 15 feet bgs

Former Kast Property

Figure **3-17**

N

MW-11
< 0.50

MW-17
36

MW-13
510

MW-16
< 0.50

MW-06
150

E 244TH ST

NEPTUNE AVE

RAVENNA AVE

PANAMA AVE

ISLAND AVE

MW-10
9.7

MW-09
< 0.50

MW-05
2.5 J

MW-15
2.1

MW-08
3.3

MW-04
1.3

E 247TH ST

E 247TH ST

HIGHLAND WAY

MW-07
0.68

MARBELLA AVE

CARMEL DR

MW-01
1.3

MW-14
130

MW-02
7.3

E 248TH ST

PETALUMA LN

E 249TH ST

MONTEREY DR

175 87.5 0 175 Feet

Legend

Monitoring Well

Approximate Groundwater Flow Direction

Site Boundary

MW-08 Monitoring well designation

33 Benzene concentration in micrograms per liter (µg/l) collected in April 2014

< : Less than detection limit

J : Estimated value

Benzene Concentrations in Groundwater - 2Q 2014
Shallow Zone Wells

Former Kast Property

Geosyntec consultants

Santa Barbara | June 2014

Figure
3-18

C:\Users\khatereh.afshar\Documents\ArcGIS\Packages\Fig8-2_Groundwater_Analysis_Benzene_Water_Table_URS_Copy\v10\Fig8-2_Groundwater_Analysis_Benzene_Water_Table_URS_Copy.mxd 20140610

N

MW-G04S
120

MW-G03S
0.24 J

E 244TH ST

NEPTUNE AVE

RAVENNA AVE

PANAMA AVE

ISLAND AVE

MW-G02S
0.19 J

E 247TH ST

E 247TH ST

HIGHLAND WAY

CARMEL DR

MARBELLA AVE

PETALUMA LN

MONTEREY DR

MW-G01S
< 0.50

E 248TH ST

E 249TH ST

C:\Users\ktatereh_atshar\Documents\ArcGIS\Packages\Fig8-3_Groundwater_Analysis_Benzene_Shallow_Gage_URS_Copy\v10\Fig8-3_Groundwater_Analysis_Benzene_Shallow_Gage_URS_Copy.mxd 20140610

Legend

- Monitoring Well
- Approximate Groundwater Flow Direction
- Site Boundary

MW-G02S Monitoring well designation
0.19 Benzene concentration in micrograms per liter (µg/l) collected in April 2014
< : Less than detection limit
J : Estimated value

175 87.5 0 175 Feet

Benzene Concentrations in Groundwater - 2Q 2014
Shallow Gage Aquifer

Former Kast Property

Geosyntec consultants

Santa Barbara | June 2014

Figure
3-19

N

MW-G04D
< 0.50

MW-G03D
< 0.50

E 244TH ST

NEPTUNE AVE

RAVENNA AVE

PANAMA AVE

ISLAND AVE

MW-G02D
< 0.50

E 247TH ST

E 247TH ST

MARBELLA AVE

HIGHLAND WAY

CARMEL DR

PETALUMA LN

MONTEREY DR

MW-G01D
< 0.50

E 248TH ST

E 249TH ST

175 87.5 0 175 Feet

Legend

Approximate Groundwater Flow Direction

Site Boundary

MW-G03D Monitoring well designation

<0.14 Benzene concentration in micrograms per liter (µg/l) collected in April 2014

< : Less than detection limit

J : Estimated value

Benzene Concentrations in Groundwater - 2Q 2014
Deep Gage Aquifer

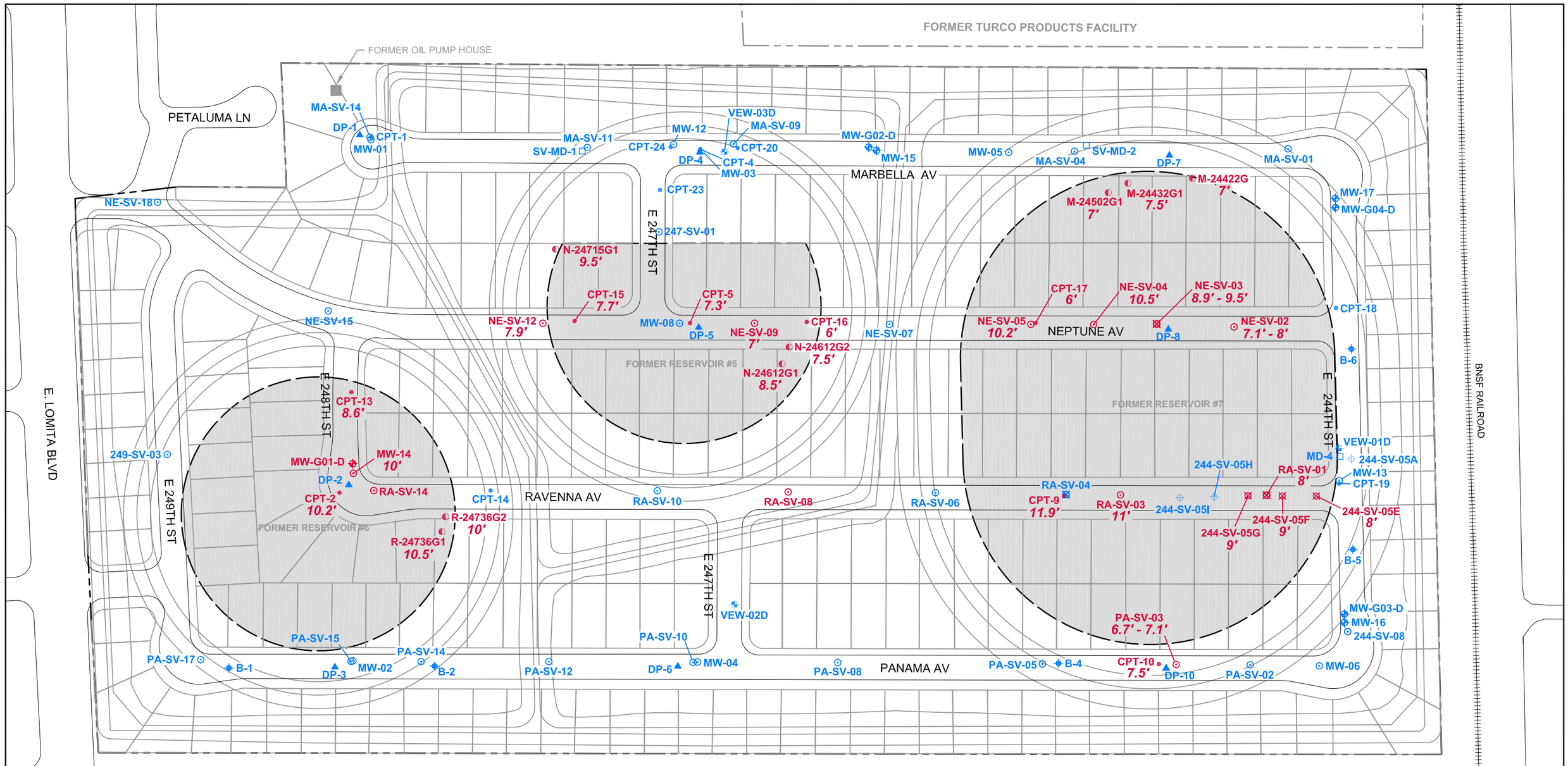
Former Kast Property

Geosyntec consultants

Santa Barbara | June 2014

Figure **3-20**

C:\Users\khatereh_afshar\Documents\ArcGIS\Packages\Fig8-4_Groundwater_Analysis_Benzene_Deep_Gage_URS_Copy\v10\Fig8-4_Groundwater_Analysis_Benzene_Deep_Gage_URS_Copy.mxd 20140610



EXPLANATION

- LOCATION OF GROUNDWATER MONITORING WELL
- LOCATION OF CPT/UVOST SOUNDING
- LOCATION OF 10-FT BGS SOIL VAPOR PROBE
- LOCATION OF 15-FT AND 20-FT BGS SOIL VAPOR PROBE
- LOCATION OF DIRECT-PUSH BORING
- LOCATION OF MULTI-DEPTH SOIL VAPOR PROBE
- APPROXIMATE LOCATION OF PILOT TEST GEOTECHNICAL BORING
- LOCATION OF SVE EXTRACTION WELL
- ADVANCED TO ≥10' BGS WITHOUT REFUSAL NOTED ON BORING LOGS OR IN FIELD NOTES
- REFUSAL AT ≤10' BGS NOTED ON BORING LOGS OR IN FIELD NOTES WITH DEPTH OF REFUSAL NOTED
- APPROXIMATE PROPERTY LINE
- ESTIMATED EXTENT OF RESIDUAL CONCRETE RESERVOIR SLABS

N

0 70 140

SCALE IN FEET

URS

ESTIMATED EXTENT OF RESIDUAL CONCRETE RESERVOIR SLABS SHOWING BORING REFUSAL IN SOIL BORINGS, MONITORING WELLS AND SOIL VAPOR PROBES INSTALLED IN STREETS

Proj. No.: 49194119	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 3-21

N

E 244TH ST

NEPTUNE AVE

RAVENNA AVE

PANAMA AVE

ISLAND AVE

E 247TH ST

E 247TH ST

E 248TH ST

E 249TH ST

MARBELLA AVE

CARMEL DR

PETALUMA LN

MONTEREY DR

HLAND WAY

NEPTUNE AVE

Legend

- < HHRA or Soil Leaching to GW Criteria
- > Soil Leaching to GW Criteria
- > HHRA Criteria
- > HHRA and Soil Leaching to GW Criteria
- No Data Available
- Antimony, Arsenic, or Thallium > Background

Notes:
ft bgs = feet below ground surface

150 75 0 150 Feet

Properties Exceeding Human Health and/or Leaching to Groundwater Criteria, ≤ 5 Feet Below Ground Surface

Former Kast Property

Geosyntec consultants

Santa Barbara | June 2014

Figure 6-1

P:\GIS\Kast\Projects\2014-06 RAP\Fig6-1_Soil_Le5ft_Kast_Residential.mxd 20140627

N

E 244TH ST

NEPTUNE AVE

RAVENNA AVE

PANAMA AVE

ISLAND AVE

E 247TH ST

E 247TH ST

MARBELLA AVE

E 248TH ST

E 249TH ST

CARMEL DR

PETALUMA LN

MONTEREY DR

HLAND WAY

NEPTUNE AVE

P:\GIS\Kast\Projects\2014-06 RAP\Fig6-2_Soil_5to10ft_Kast_Residential.mxd 20140627

Legend

- < HHRA or Soil Leaching to GW Criteria
- > Soil Leaching to GW Criteria
- > HHRA Criteria
- > HHRA and Soil Leaching to GW Criteria
- No Data Available
- Antimony, Arsenic, or Thallium > Background

Notes:
ft bgs = feet below ground surface

150 75 0 150 Feet

Properties Exceeding Human Health and/or Leaching to Groundwater Criteria, > 5 Feet and ≤ 10 Feet Below Ground Surface

Former Kast Property

Geosyntec consultants

Santa Barbara | June 2014

Figure 6-2

E 244TH ST

E 247TH ST

E 248TH ST

E 249TH ST

NEPTUNE AVE

RAVENNA AVE

PANAMA AVE

ISLAND AVE

MARBELLA AVE

CARMEL DR

PETALUMA LN

MONTEREY DR

HLAND WAY

N

150 75 0 150 Feet

Legend

- TPH Concentrations > 10x SSCG
- Targeted Excavation Area
- Pool
- Site Boundary

Notes:

NSE = No Shallow Excavation Planned
P = Pool
W = Water Main
ND = No Data

Properties Identified for Targeted Excavation
> 5 and ≤ 10 Feet Below Ground Surface

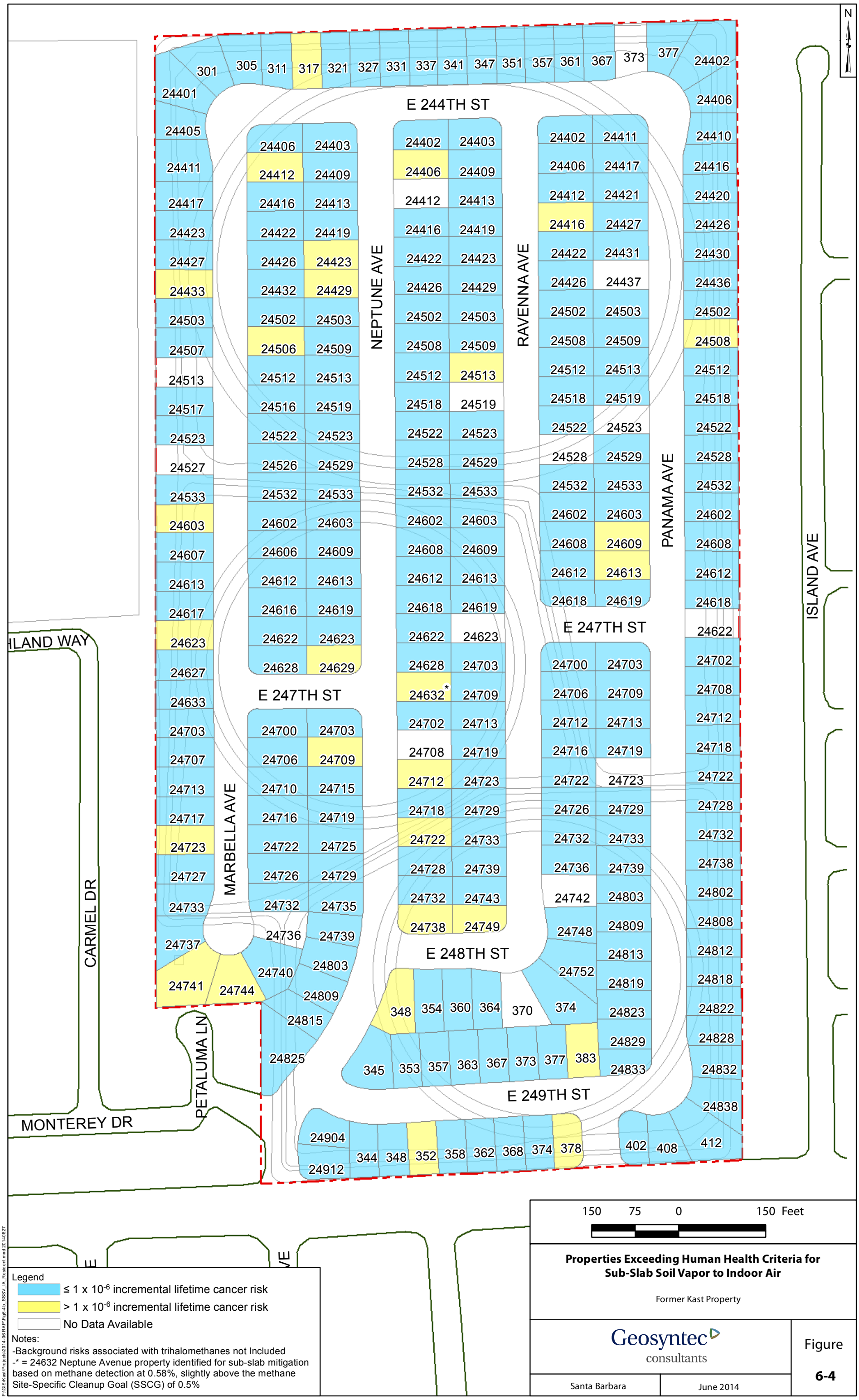
Former Kast Property

Geosyntec consultants

Santa Barbara | June 2014

Figure 6-3

P:\GIS\K:\est\Projects\2014-06 RAP\Fig6-3_Targeted_Excavation_Area_gt5and10ft.mxd 20140627


N
E 244TH ST
NEPTUNE AVE
RAVENNA AVE
PANAMA AVE
ISLAND AVE
E 247TH ST
MARBELLA AVE
E 248TH ST
E 249TH ST
CARMEL DR
PETALUMA LN
MONTEREY DR
HLAND WAY
150 75 0 150 Feet
Legend
≤ 1 x 10-6 incremental lifetime cancer risk
> 1 x 10-6 incremental lifetime cancer risk
No Data Available
Notes:
-Background risks associated with trihalomethanes not Included
-* = 24632 Neptune Avenue property identified for sub-slab mitigation based on methane detection at 0.58%, slightly above the methane Site-Specific Cleanup Goal (SSCG) of 0.5%
Properties Exceeding Human Health Criteria for Sub-Slab Soil Vapor to Indoor Air
Former Kast Property
Geosyntec consultants
Santa Barbara
June 2014
Figure 6-4
P:\GIS\Kast\Projects\2014-06 RAP\Fig6-4b_SSSV_IA_Resident.mxd 20140627

BAYVIEW AV
NEPTUNE AV
RAVENNA AV
LAGOON AV
E LOMITA BLVD
CARMEL DR
HIGHLAND WY
MONTEREY DR
PETALUMA LN
FORMER TURCO PRODUCTS FACILITY
FORMER OIL PUMP HOUSE
MARBELLA AV
E 247TH ST
FORMER RESERVOIR #5 (CRUDE OIL)
NEPTUNE AV
E 248TH ST
FORMER RESERVOIR #7 (CRUDE OIL)
E 244TH ST
BNSF RAILROAD
REALTY ST.
RAVENNA AV
E 249TH ST
FORMER RESERVOIR #6 (CRUDE OIL)
E 247TH ST
PANAMA AV
ISLAND AV

EXPLANATION

APPROXIMATE PROPERTY LINE

CONCEPTUAL STREET EXTRACTION WELL RADIUS OF VACUUM INFLUENCE (50 FEET)
128 SHALLOW WELLS AT APPROXIMATELY 62.5-FOOT SPACING

CONCEPTUAL RESIDENTIAL EXTRACTION WELL RADIUS OF VACUUM INFLUENCE (25 FEET)
472 SHALLOW WELLS AT 221 RESIDENCES

N

0 80 160

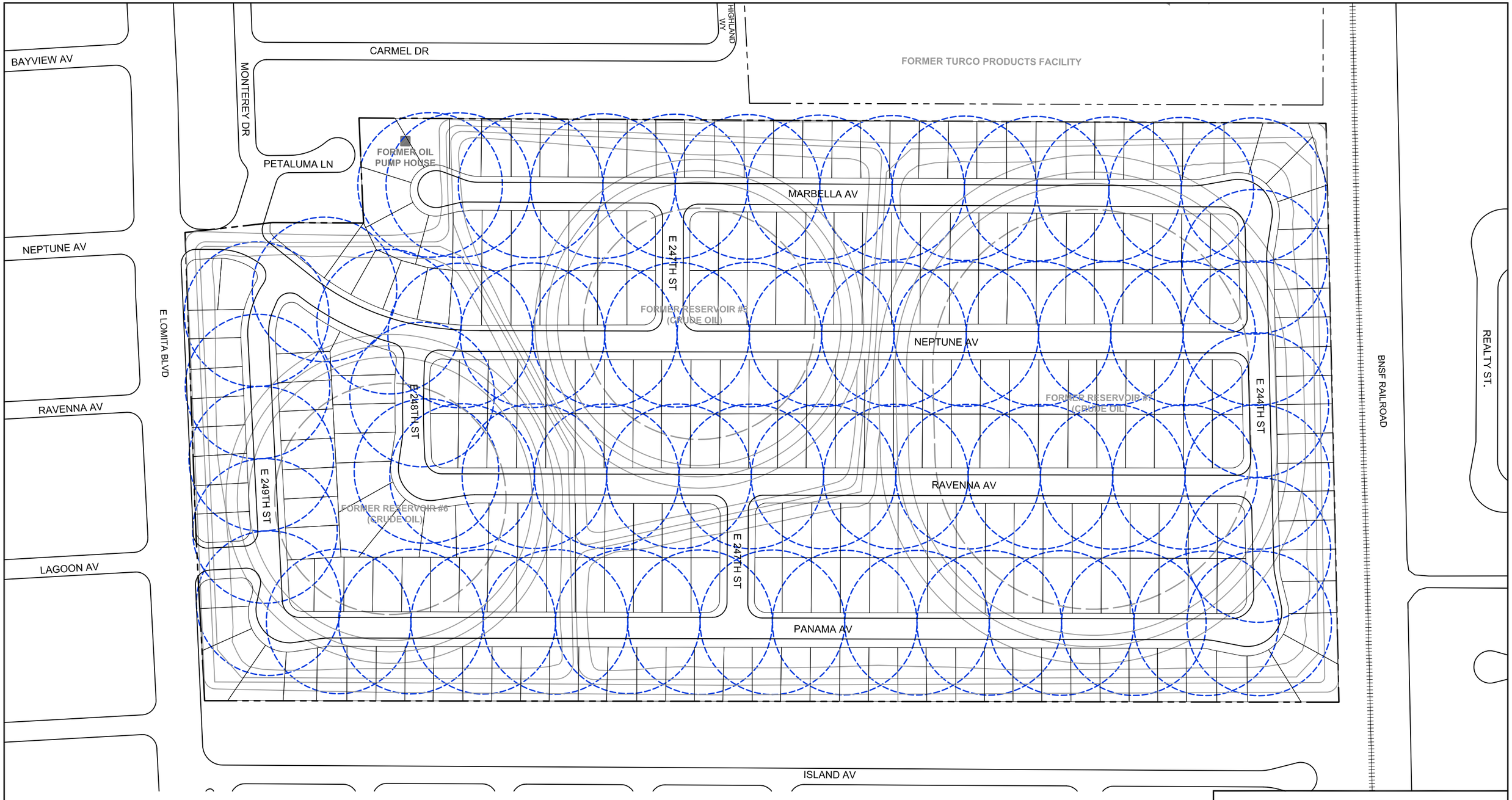
SCALE IN FEET

URS

CONCEPTUAL VAPOR EXTRACTION COVERAGE FOR THE SHALLOW ZONE

Proj. No.: 49194119	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 8-1

G:\1 Shell Products - Former Kast Property\RAP\SVE\Figure 8-1 Conceptual Vapor Extraction Coverage - Shallow Zone 062714.dwg , File date: 6/27/2014 4:33 PM, Print date: 6/27/2014 4:33 PM by: Sevilla, Vincent



EXPLANATION

- APPROXIMATE PROPERTY LINE
- CONCEPTUAL INTERMEDIATE EXTRACTION WELL
  RADIUS OF VACUUM INFLUENCE (125 FEET)
  63 WELLS AT APPROXIMATELY125-FOOT SPACING

N

0 80 160

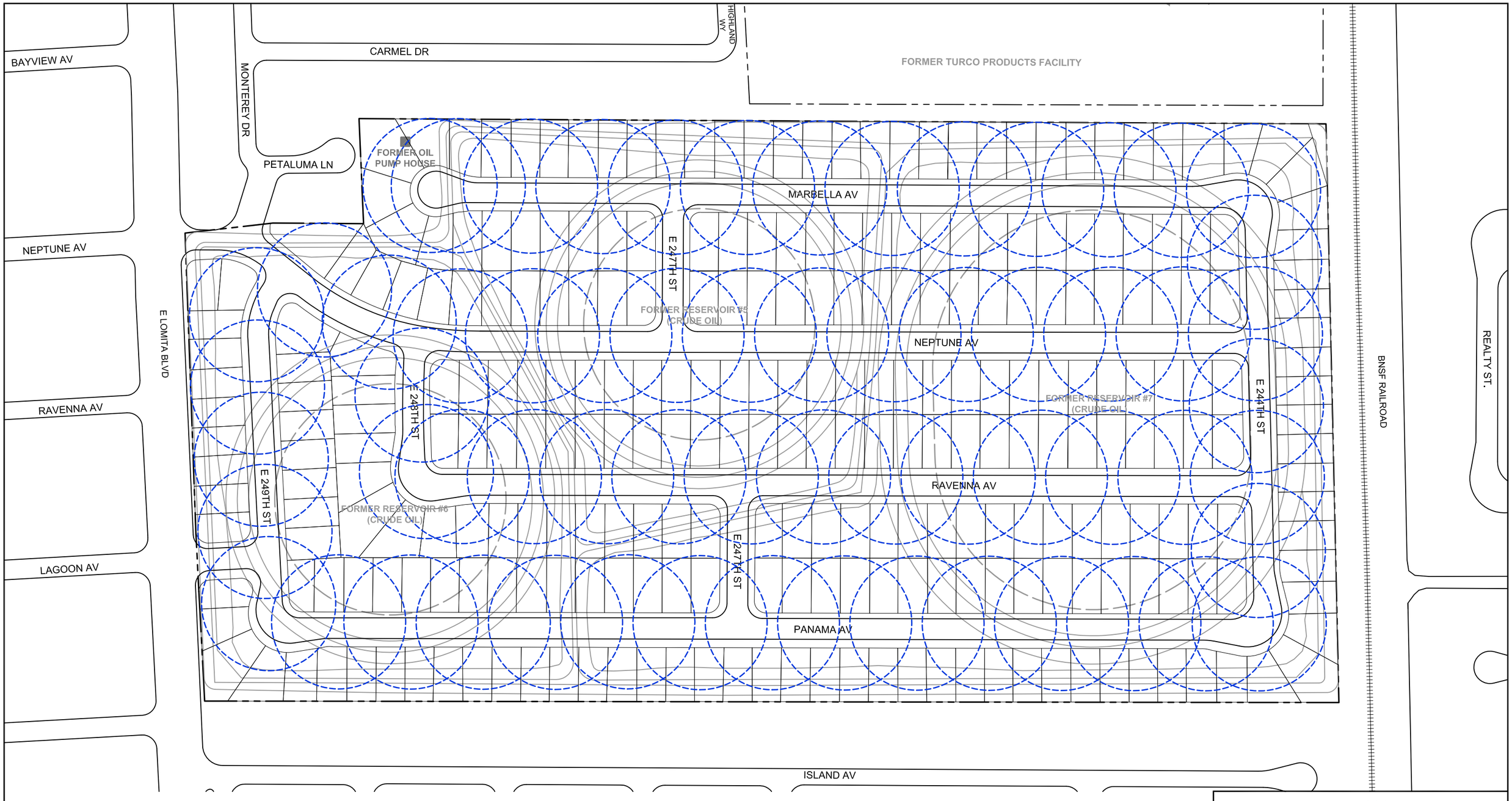
SCALE IN FEET

URS

CONCEPTUAL VAPOR EXTRACTION COVERAGE FOR THE INTERMEDIATE ZONE

Proj. No.: 49194119	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 8-2

G:\1 Shell Products - Former Kast Property\RAP\SVE\Figure 8-2 Conceptual Vapor Extraction Coverage - Intermediate Zone.dwg , File date: 6/27/2014 4:29 PM, Print date: 6/27/2014 4:29 PM by: Sevilla, Vincent



EXPLANATION

- APPROXIMATE PROPERTY LINE
- CONCEPTUAL DEEP EXTRACTION WELL
  RADIUS OF VACUUM INFLUENCE (116 FEET)
  63 WELLS AT APPROXIMATELY125-FOOT SPACING

N

0 80 160

SCALE IN FEET

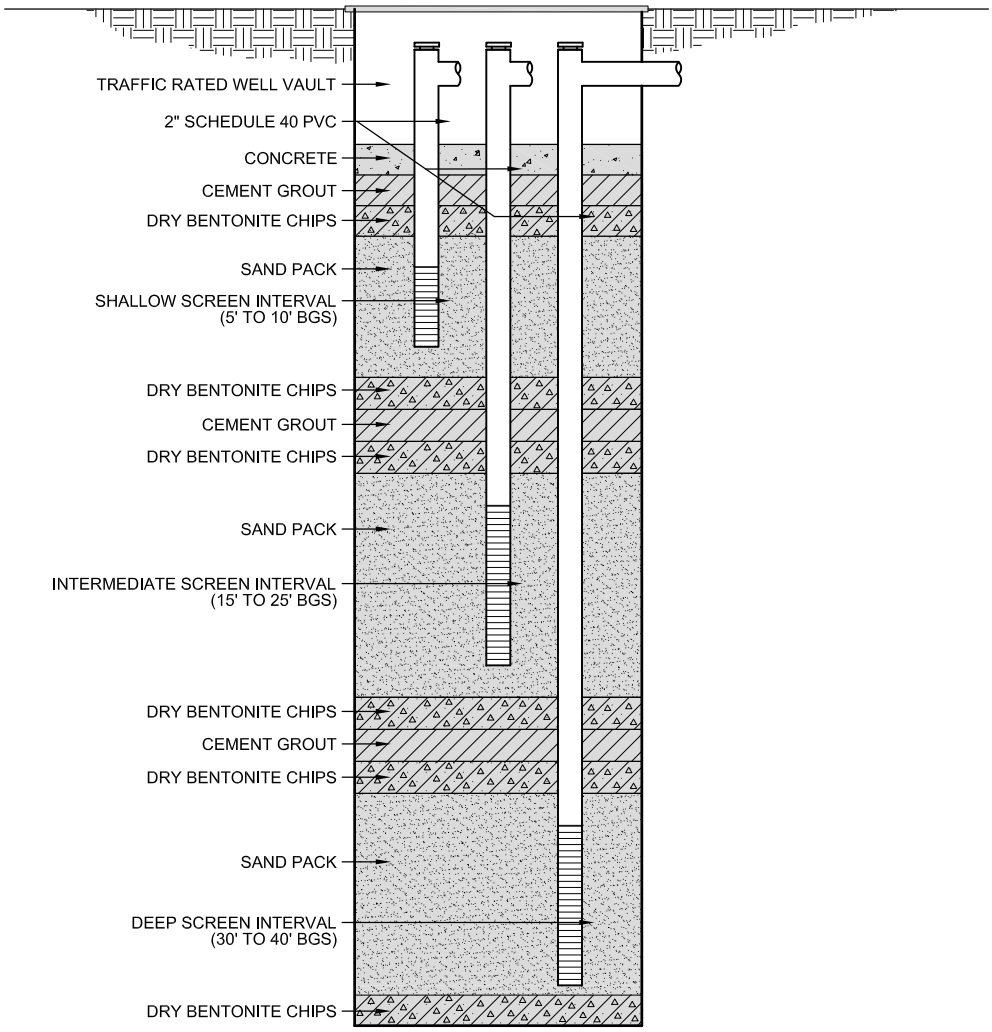
URS

CONCEPTUAL VAPOR EXTRACTION COVERAGE FOR THE DEEP ZONE

Proj. No.: 49194119	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 8-3

G:\1 Shell Products - Former Kast Property\RAP\SVE\Figure 8-3 Conceptual Vapor Extraction Coverage - Deep Zone.dwg , File date: 6/27/2014 4:31 PM, Print date: 6/27/2014 4:31 PM by: Sevilla, Vincent

TRIPLE COMPLETION STREET SOIL VAPOR EXTRACTION WELL



BORING DIAMETER: 11 3/4"
TOTAL DEPTH (APPROXIMATE): 42' BGS

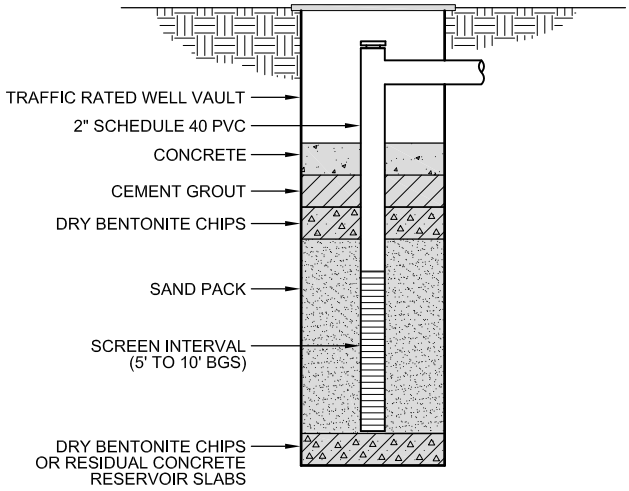
NOTES:
BGS = BELOW GROUND SURFACE
PVC = POLYVINYLCHLORIDE

URS

TYPICAL NESTED WELL CONSTRUCTION DETAIL

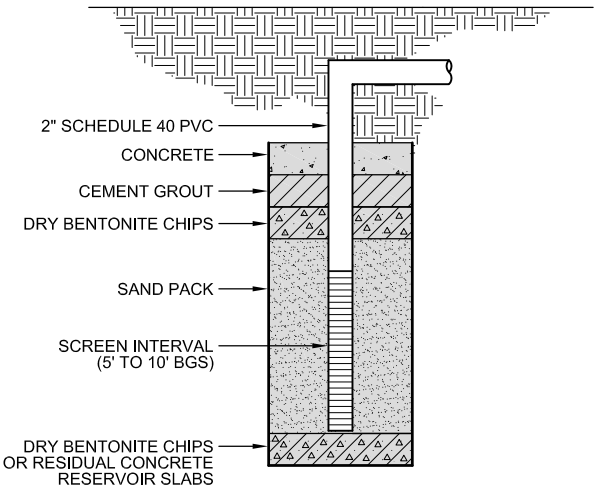
Proj. No.: 49194119	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 8-4

SHALLOW STREET SOIL VAPOR EXTRACTION WELL



BORING DIAMETER: 6 3/4" MINIMUM
TOTAL DEPTH (APPROXIMATE): 11' BGS

SHALLOW RESIDENTIAL SOIL VAPOR EXTRACTION WELL



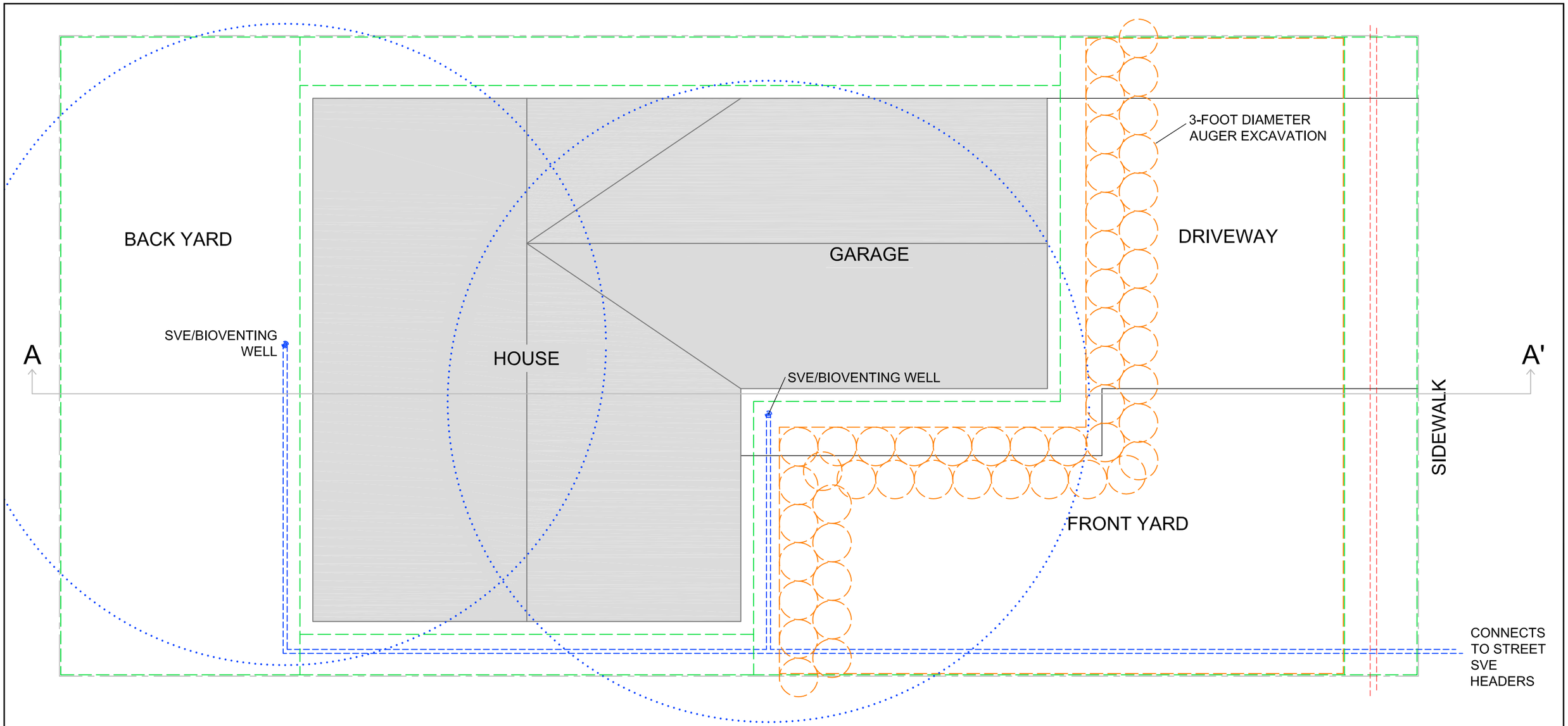
BORING DIAMETER: 6 3/4" MINIMUM
TOTAL DEPTH (APPROXIMATE): 11' BGS

NOTES:
BGS = BELOW GROUND SURFACE
PVC = POLYVINYLCHLORIDE

URS

TYPICAL SHALLOW WELL CONSTRUCTION DETAIL

Proj. No.: 49194119	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 8-5



PLAN VIEW

0 5 10

SCALE IN FEET

EXPLANATION

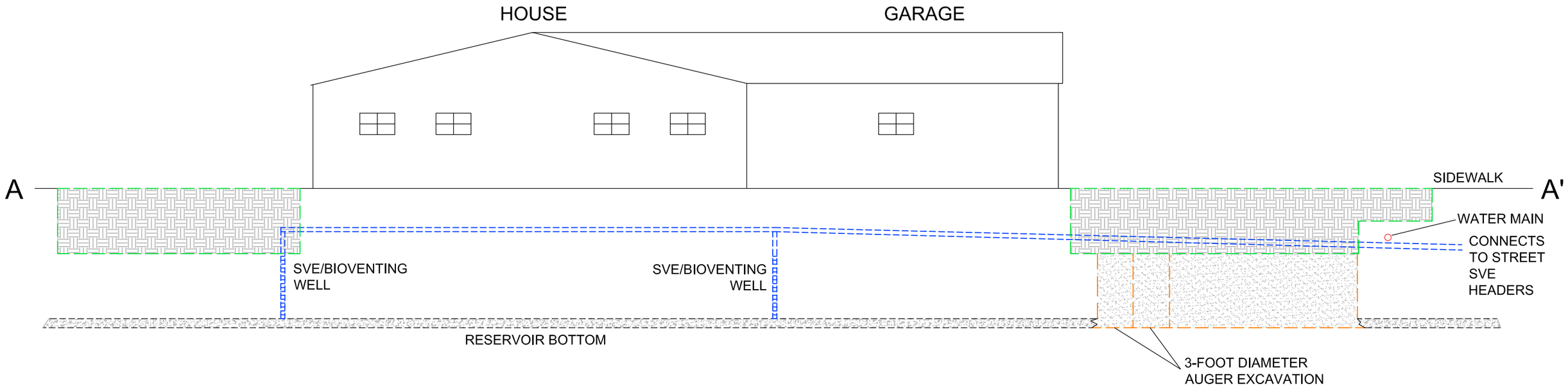
- APPROXIMATE PROPERTY LINE
- 5-FOOT EXCAVATION AREA
- 10-FOOT TARGETED EXCAVATION
- SOIL VAPOR EXTRACTION/BIOVENTING SYSTEM PIPING
- CONCEPTUAL RESIDENTIAL EXTRACTION WELL RADIUS OF INFLUENCE
- WATER MAIN

URS

CONCEPTUAL REMEDIATION AT A RESIDENCE - 5-FT EXCAVATION, 5 TO 10-FT TARGETED EXCAVATION, AND SVE/BIOVENTING PLAN VIEW

Proj. No.: 49194119	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 8-6

G:\1 Shell Products - Former Kast Property\RAP\SVE\Figure 8-6_7 Remediation Typical House 063014.dwg , File date: 6/30/2014 7:14 AM, Print date: 6/30/2014 7:15 AM by: Sevilla, Vincent



A-A' CROSS SECTION VIEW

EXPLANATION

- 5-FOOT EXCAVATION
- 10-FOOT TARGETED EXCAVATION
- SOIL VAPOR EXTRACTION/BIOVENTING WELL AND SYSTEM PIPING (PIPING IS PROJECTED ONTO CROSS-SECTION FROM SIDE YARD LOCATION)
- SOIL BACKFILL
- SLURRY BACKFILL

0 5 10

SCALE IN FEET

URS

CONCEPTUAL REMEDIATION AT A RESIDENCE - 5-FT EXCAVATION, 5 TO 10-FT TARGETED EXCAVATION, AND SVE/BIOVENTING
A-A' CROSS-SECTION VIEW

Proj. No.: 49194119	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 8-7

G:\1 Shell Products - Former Kast Property\RAP\SVE\Figure 8-6_7 Remediation Typical House 063014.dwg , File date: 6/30/2014 7:14 AM, Print date: 6/30/2014 7:14 AM by: Sevilla, Vincent

EXPLANATION

POTENTIAL OFF-SITE SVE LOCATION ALTERNATIVES

- A — Former Turco Property
- B — Business park at 24412 So. Main Street
- C — Vacant land north of MTA/BNSF rail line

N

0 150 300

SCALE IN FEET

URS

POTENTIAL SOIL VAPOR EXTRACTION TREATMENT SYSTEM LOCATIONS

Proj. No.: 49194119	Date: JUNE 2014
Project: FORMER KAST PROPERTY	Figure: 8-8

G:\1 Shell Products - Former Kast Property\RAP\SVE\Figure 8-8 Potential SVE System Locations.dwg , File date: 6/30/2014 1:36 PM , Print date: 6/30/2014 1:37 PM by: Sevilla, Vincent

N

MW-11
< 0.5

MW-17
36

E 244TH ST

MW-13
510

MW-16
< 0.5

MW-06
150

NEPTUNE AVE

RAVENNA AVE

PANAMA AVE

ISLAND AVE

MW-10
9.7

MW-05
2.5 J

MW-15
2.1

MW-08
3.3

E 247TH ST

MW-04
1.3

MW-09
< 0.5

HIGHLAND WAY

MW-07
0.68

MARBELLA AVE

CARMEL DR

MW-14
130

MW-02
7.3

MW-01
1.3

E 248TH ST

PETALUMA LN

E 249TH ST

MONTEREY DR

Legend

- Monitoring Well
- Oxygen Release Compound Injection Well
- 15ft Radial Zone of Influence for Oxygen Release Compound Injection Well
- Approximate Groundwater Flow Direction
- Site Boundary

MW-08 Monitoring well designation
33 Benzene concentration in micrograms per liter (µg/l) collected in April 2014
< : Less than reporting limit
J : Estimated value

175 87.5 0 175 Feet

In-Situ Groundwater Remedy Preliminary Design, Oxidant Injection

Former Kast Property

Geosyntec consultants

Santa Barbara | June 2014

Figure 8-9

P:\GIS\KastProjects\2014-06 FS\Figs-1_FS_InSitu_GW_Remedy_Prelim_Design_Oxidant_Injection.mxd 20140619

APPENDIX A

CROSS-REFERENCE TABLE OF REGIONAL BOARD REQUIREMENTS ADDRESSED IN THE REVISED HHRA, FS, AND RAP

CROSS-REFERENCE TABLE OF REGIONAL BOARD REQUIREMENTS
ADDRESSED IN THE REVISED HHRA, FS, AND RAP
Former Kast Property

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
RWQCB, Review of Remedial Action Plan, Feasibility Study Report and Human Health Risk Assessment Report Pursuant to California Water Code Section 13304 Order. Letter to Shell Oil Products US dated April 30, 2014.				
RWQCB-1	Page 2 First Paragraph Page 3 Second Paragraph	*This letter also directs Shell to revise the RAP, FS, and HHRA consistent with comments from OEHHA and the UCLA Expert Panel.*	The RAP, FS, and HHRA have been revised in accordance with the comments from RWQCB, OEHHA, and the UCLA Expert Panel. The documents are submitted separately, but concurrently. This Response to Comments (RTC) table lists each comment received from RWQCB, OEHHA, and the UCLA Expert Panel as well as where the comment is addressed or how it was evaluated (which document and which section).	Revised RAP Revised FS Revised HHRA
RWQCB-2	Page 6 List Item 2	*Soil vapor extraction (SVE) and bio venting will be implemented to reduce waste concentrations in soil and soil vapor at residential properties which have been identified having soil or soil vapor that exceed SSCGs at depths below three feet bgs. SVE and biovent wells will be installed in City streets and private yards to implement these technologies.*	SVE/bioventing is proposed as part of the selected Site remedy described in the Revised RAP. SVE/bioventing is proposed to address COCs in Site soils and soil vapor not addressed by the proposed excavation to 5 feet and locally bgs from 5 to 10 feet bgs.	Revised FS, Sections 5,6,7, and 8 Revised RAP Section 8
RWQCB-3	Page 8 First Paragraph	*The RAP is based, in part, on SSCGs that were not approved by the Regional Board, and consequently the RAP will not achieve the approved SSCGs and cleanup objectives.*	The Revised HHRA, Revised FS and Revised RAP have been revised to use the Regional Board approved SSCGs provided in their January 23, 2014 letter and as corrected in their May 29, 2014 correspondence.	Revised HHRA Revised FS Revised RAP
RWQCB-4	Page 8	*…the Regional Board does not concur that the proposed RAP has a substantial*	The Revised RAP describes a proposed remedy expected to meet the approved RAOs and SSCGs	Revised FS, Section 6.2.2.4

CROSS-REFERENCE TABLE OF REGIONAL BOARD REQUIREMENTS
ADDRESSED IN THE REVISED HHRA, FS, AND RAP
Former Kast Property

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
	First Paragraph	*likelihood to achieve compliance with approved SSCGs within a reasonable time frame, nor meet the cleanup goals and objectives that implement the applicable Water Quality Control Plans and Policies in a reasonable time frame…*	in a reasonable time frame. The proposed excavation of shallow soils will result in protection of human health as well as mass removal of COCs over the relatively short term (approximately 5 years). Deeper impacts which do not impact human health and impacts in un-excavated areas will be addressed over a longer term (approximately 30-40 years) through SVE/bioventing for soil/soil vapor. Groundwater impacts will be addressed over the long term through MNA. A contingent remedial measure of oxidant injection for groundwater is also included in the RAP should monitoring data indicate additional actions are necessary based on an increasing plume.	Revised RAP, Section 8.
RWQCB-5	Page 8 Site-Specific Cleanup Goals Numbered Paragraph 1	*In developing the RAP, Shell used generic guidance from the Regional Board's Underground Storage Tank (UST) program to define SSCGs for TPH in soil (Interim Site Assessment and Cleanup Guidebook, May, 1996). However, there are Site specific data available that indicate the generic UST cleanup goals are not sufficient to reduce the leaching potential of waste from soil to groundwater at the Site. SSCGs for TPH in soil based on Site specific soil characteristics were calculated in the Revised SSCG Report and approved by the Regional Board, however, these approved SSCGs were not used to develop the RAP.*	In the March 10, 2014 HHRA, Shell proposed modifications to certain of the soil SSCGs for total petroleum hydrocarbons (TPH) to protect groundwater based on the Regional Board's 1996 Interim Site Assessment & Cleanup Guidebook (RWQCB, 1996a). However, the RWQCB comments directed Shell to use the TPH SSCGs included in their January 23, 2014 letter. The Revised HHRA, Revised FS, and Revised RAP use the latest SSCGs approved by the RWQCB as corrected in their May 29, 2014 correspondence.	Revised HHRA Revised FS Revised RAP

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		Consequently, the generic cleanup goals proposed in the RAP are not appropriate for the Site. The RAP also inappropriately applied a dilution/attenuation factor to the UST program cleanup goals and proposed less stringent SSCGs than are needed to reduce the leaching potential of TPH from soil to groundwater. The dilution / attenuation factor used by Shell to set a less stringent SSCG for TPH in soil was not approved by the Regional Board in the January 23, 2014 letter. The January 23, 2014 letter amended the CAO, approved appropriate SSCGs, and directed Shell to use the approved SSCGs in the development of the RAP. However, the RAP is not based on the SSCGs that are approved by the Regional Board. The Regional Board cannot concur that the SSCGs used to develop the RAP will attain SSCGs necessary to protect groundwater quality.		
RWQCB-6	Page 8 Site-Specific Cleanup Goals Numbered Paragraph 2	*Sub-slab mitigation is necessary because the proposed remedy does not include removal of waste beneath houses at the Site.*	The revised HHRA includes a vapor intrusion evaluation using a sub-slab to soil vapor attenuation factor from which 27 properties were identified for vapor mitigation based on RAO exceedance for potential vapor intrusion and one property was identified based on methane. While the data collected at the Site do not indicate that vapor intrusion is an issue at any of the residences, Shell is prepared to offer installation of a sub-slab mitigation system to any of the	RAP Section 8.3

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
			homeowners in the Carousel neighborhood to alleviate concerns about potential impact to their indoor air from the Site. Additionally, impacts in un-excavated areas will be addressed over a longer term (approximately 30-40 years) through SVE/bioventing for soil/soil vapor.	
RWQCB-7	Page 9 Site-Specific Cleanup Goals Numbered Paragraph 2	*The attenuation factor approved in the Regional Board's January 23, 2014 letter addressed development of SSCGs for soil vapor in shallow soil, not SSCGs in sub-slab soil vapor. By using non-approved SSCGs for sub-slab soil vapor and failing to develop a SSCG for soil vapor in shallow soil, the RAP may underestimate the number of houses that need sub-slab mitigation measures to reduce the potential for vapor intrusion. This issue was discussed in the Regional Board's January 23, 2014 letter and the UCLA Expert Panel Report attached to the Regional Board's January 23, 2013 letter.*	The Revised SSCG Report presented a single set of soil vapor SSGCs for the site for the vapor intrusion pathway, encompassing sub-slab soil vapor and soil vapor. Section 7.1.1.5 of the Revised SSCG Report states that values listed in Table 7-2 (which are repeated in Table 9-3 of the Revised SSCG Report) are the SSCGs for sub-slab soil vapor at the Site. If the attenuation factor of 0.002 referenced by the Regional Board in the January 23, 2014 letter was not intended to be applied to these sub-slab soil vapor cleanup goals, then it is not clear that the Regional Board made any comment on the sub-slab to soil vapor SSCGs. It should be noted that the values presented in Table 2 in the Regional Board's January 23, 2014 letter are the sub-slab soil vapor cleanup goals proposed by Shell but adjusted to reflect the attenuation factor of 0.002 rather than the attenuation factor of 0.001 used in the Revised SSCG Report. The Regional Board soil vapor SSCGs were then applied to the sub-slab soil vapor data in the risk assessment as this is considered the most robust and relevant dataset to	Revised HHRA, Appendix D Revised RAP, Section 8.3

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
			evaluate potential vapor intrusion at this site. An updated assessment of the sub-slab soil vapor to indoor air attenuation factor is presented in Appendix D of the HHRA. This updated assessment demonstrates that an attenuation factor of 0.002 is a conservative upper-bound value based on evaluation of the empirical data (i.e., sub-slab and indoor air concentration measurements) collected at the Site. In addition, while the data do not indicate that vapor intrusion is an issue at any of the residences, Shell is prepared to offer installation of a sub-slab mitigation system to any of the homeowners in the Carousel neighborhood to alleviate concerns about potential impact to their indoor air from the Site.	
RWQCB-8	Page 9 Site-Specific Cleanup Goals Numbered Paragraph 2	*The Regional Board's January 23, 2013 letter required Shell to consider the results in the Site Delineation Reports (Plume Delineation Report, URS, September 29, 2010; and Supplemental Site Delineation Report, URS, May 27, 2011) and in the property-by-property investigations in developing the RAP. However, the RAP considered only the results of the property-by-property investigations, and did not consider the Site Delineation Reports.*	The Regional Board's January 23, 2014 letter to Shell states (at page 9) that "Shell shall consider (emphasis added) the results in the Site Delineation Report soil concentrations contours and the results of the property-by-property investigations in developing the RAP." (Shell assumes the Regional Board is referring to the Plume Delineation Report.) This comment was discussed with the Regional Board during the January 24, 2014 meeting. Shell requested clarification from the Regional Board on what they were referring to with respect to the Site Delineation Report and soil concentration	Revised RAP Section 3.3.1 and Figures 3-3 through 3-17

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
			contours and the word "consider" was emphasized by the Regional Board staff at that time. These data sets were clearly considered and the soil vapor extraction/bioventing system was included in the RAP to address the distribution of petroleum hydrocarbons identified in the Plume Delineation Report, soil concentrations contours, and the results of the property-by-property investigations. Moreover, the following data sets were expressly considered in the HHRA, FS and RAP submitted on March 10, 2014: • Analytical results presented in the Plume Delineation Report as well as data collected from area-wide and residential property investigations. • Soil and soil vapor concentration contour maps were updated with more recent data, and included the updated contour maps in Appendix B of the March 10, 2014 RAP. • Analytical results from the property-by-property investigations were included in tables and figures included the March 10, 2014 HHRA and RAP. The data identified in the Regional Board's January 23, 2014 letter to Shell were considered in the preparation of the March 10, 2014 RAP. The following tables and figures in the RAP	

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			show where these factors were considered: • HHRA Tables 1a through 3 • HHRA Appendix E • RAP Figures 3-3 through 3-14 • RAP Appendix B Figures showing the updated contour plots in soil and soil vapor have been created and are provided on Figures 3-9 through 3-17 in the Revised RAP. Due to the interpolation inherent in the software used to extrapolate between data points to generate the contours, these maps are not necessarily representative of the actual distribution of impacts. Also, it should be noted that these maps interpolate data from known sample points to areas where no sampling has been conducted and therefore show the presence of impacts based on extrapolation where there are not data to confirm whether impacts actually exist. In the Revised FS a version of the EVS software, Mining Visualization Software (MVS), was used to interpolate TPH concentrations throughout the Site by kriging. These interpolated concentrations and contours were used to identify residences where residential SVE/bioventing wells are proposed and to identify properties for targeted deeper excavation.	

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RWQCB-9	Page 9 Excavation First Paragraph	*The RAP proposes to excavate impacted soil from areas around houses that contain waste that exceeds SSCGs for TPH and other COCs in soil to a depth of three feet bgs. The Regional Board has several concerns with the excavation proposed by the RAP and FS (discussed further below) pertaining to the proposed excavation depth. Excavations to three feet bgs may not be sufficient to address nuisance caused by waste at the Site, may not protect residents from exposure to waste during some types of residential activities, and will leave a considerable mass of waste in Site soil that can continue to leach to groundwater. The waste mass in soil below three feet bgs will result in an unreasonable time frame needed for other components of the RAP such as SVE, bioventing, and MNA to achieve the SSCGs.*	Based on analyses presented in the FS and Revised FS, Shell believes that Alternative 4B (excavation around houses exceeding SSCGs to 3 feet) effectively balances the concerns identified by the RWQCB. The analysis in the Revised FS Report shows that the incremental benefit of deeper excavation beyond that proposed in Alternative 4B (3 feet excavation) must be viewed in the context of the additional duration, impacts, and nuisance to the community. Shell recognizes the lingering concerns of RWQCB that alternatives that excavate to a deeper depth may be marginally more protective in the event of inadvertent residential excavation without seeking a City permit. Therefore, in response to the RWQCB's comments and in the interest of State Acceptance, Alternative 4B (excavation to 3 feet) will not be recommended as the preferred alternative. Instead, the Revised FS recommends Alternative 4D which includes excavation around houses exceeding soil RAOs to 5 feet, with targeted excavation locally to 10 feet to remove additional hydrocarbon mass. The Revised RAP describes a proposed remedy expected to meet the approved RAOs and SSCGs in a reasonable time frame. The proposed excavation of shallow soils will result in protection of human health as well as mass	Revised FS Section 6.3.3. Section 7 Section 8 Revised RAP Section 8

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			removal of COCs over the relatively short term (approximately 5 years). Deeper soil impacts which do not impact human health will be addressed over a longer term (approximately 30-40 years) through SVE/bioventing for soil/soil vapor. SVE/bioventing will relatively quickly remove the volatile and most leachable TPH and VOC fractions from the vadose zone over the entire Site. Groundwater impacts will be addressed over the long term through MNA. A contingent remedial measure of oxidant injection for groundwater is also included in the RAP should monitoring data indicate additional actions are necessary.	
RWQCB-10	Page 9 Excavation Numbered Paragraph 1	*The Site investigation characterized soil from samples taken at depths of two feet, five feet and ten feet bgs. Waste was detected at all depths investigated and Site data show that the waste concentration, and thus waste mass, increases significantly with depth. Consequently, the proposed RAP excavation depth to three feet leaves significant quantities of waste in soil at levels that exceed the SSCGs necessary to reduce the leaching of waste from soil to groundwater.*	The Revised FS contains an analysis of the distribution of TPH mass at the Site, as well as an analysis of the TPH mass to be removed under the various excavation scenarios. Approximately 75% of the TPH mass at the Site resides in the 10-50 foot range. Thus, any excavation scenario in the upper 10 feet of the Site will leave substantial mass in place. However, the deeper mass, along with mass not subject to excavation in the upper 10 feet is generally not a source of direct contact risk to human receptors and will be remediated through SVE/bioventing. SVE/bioventing is expected to relatively quickly remove the most leachable fraction of TPH and other VOCs.	Revised FS Section 5.2.3. Revised RAP Section 8

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			Again, the Revised RAP proposes excavation around houses exceeding SSCGs to 5 feet, with targeted excavation locally to 10 feet to remove additional hydrocarbon mass. SVE/bioventing will relatively quickly remove the most leachable TPH and VOC fractions from the entire Site.	
RWQCB-11	Page 9 Excavation Numbered Paragraph 2	*The RAP relies on SVE, bioventing, free-product removal, and monitored natural attenuation (MNA) to reduce the waste in soil that will not be removed by excavation. However, these technologies have not been proven effective in reducing waste concentrations at the Site in a reasonable time frame as required by Resolution 92-49. The bioventing pilot test (Biovent Pilot Test Summary Report, Geosyntec, December 6, 2012) indicated, for example, that time frames of greater than 80 years may be required to reduce waste concentrations to attain the SSCGs for soil. The RAP estimates of SVE duration are based on the time necessary to vent a specific number of soil pore volumes. The basis for the SVE time frame estimates may not be accurate because the mass of sorbed COCs to the Site soils may continue to volatilize into the soil pores as they are vented. Based on information provided in the RAP, the Regional Board cannot concur that SVE and bioventing will attain SSCGs in a*	The remedy described in the Revised RAP proposes SVE/bioventing to reduce COCs in soil not removed by excavation. SVE/bioventing will relatively quickly remove the most leachable TPH and VOC fractions from the entire Site. It is inappropriate to reference the bioventing time frame presented in the Bioventing Pilot Test Summary Report to estimate the time frame for the SVE/bioventing system, because the Bioventing Pilot Test was based on using small fans to introduce oxygen to the subsurface and not the robust SVE/bioventing system that is proposed. The application of both of these technologies together will reduce the time frame based on bioventing alone. Additional details regarding the estimated time frame for the SVE/bioventing system to achieve the RAOs have been included in the Revised FS and Revised RAP.	Revised FS, Section 6.2.2.4 Revised RAP, Section 8.2

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		reasonable time frame.		
RWQCB-12	Page 10 Excavation Numbered Paragraph 3	*The RAP indicates that excavation of residential properties to three feet bgs would effectively limit exposure to residents who may engage in gardening or construction of residential yard features that require digging because there are existing institutional controls through the City of Carson building codes. However, the institutional controls cited by the RAP may not be effective in limiting residential exposure to waste because the institutional controls may not apply to excavations that generate small volumes of soil that are typical of residential activities.*	Institutional controls already are in place for excavations 3 feet or deeper at the Site. The City of Carson Building Code Section 8105, which amends the L.A. County Building Code Section 7003.1, is an existing institutional control that would limit, through permitting processes, contact with impacted soils beneath a depth of 3 feet. This existing institutional control supports any soil excavation remedy to depths ≥ 3 feet. Because of this code provision, the City must be notified and approve excavations deeper than 3 feet. The City could readily inform residents and workers of other appropriate precautions necessary for excavations below 3 feet through existing administrative processes, and also notify Shell that monitoring and disposal may be required. Shell would coordinate with the City of Carson to establish a process through existing building and grading permit reviews, General Plan overlay or footnote, area plan, or similar process, to ensure that if a property owner were to conduct activities involving excavations greater than 3 feet deep (such as building renovation, installation of a pool or deeper landscape alterations), Shell would be notified so that the company could arrange for sampling and proper handling of impacted soils. Based upon the above analysis, Shell believes excavation to 3 feet is protective of a resident's	Revised FS Section 6.3.3.1 Revised RAP Section 8.1

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			potential exposure to soils with COCs. Nevertheless, Shell proposes excavation around houses exceeding soil RAOs to 5 feet, with targeted excavation locally to 10 feet to remove additional mass. Furthermore, as previously described by the Expert Panel (Newfields, 2014), USEPA (2003) has indicated that "Twenty-four (24) inches of clean soil cover is generally considered to be adequate for gardening areas…". Thus, the potential for a resident to contact soils below 3 feet is low.	
RWQCB-13	Page 10 SVE/Bioventing, LNAPL Removal and Monitored Natural Attenuation Numbered Paragraph 1	*Pilot tests of SVE and bioventing indicated that more than 80 years may be necessary to reduce waste concentrations to a level at which leaching to the groundwater will be reduced in order to attain the SSCGs for groundwater in a reasonable time frame.*	The RWQCB estimate is based on the results of the bioventing pilot test but did not consider the additional impact of the proposed SVE on the remediation time frame. SVE will relatively quickly remediate the more volatile fractions of TPH; thus bioventing will target a smaller mass of residual TPH. This will shorten the time frame for the SVE/bioventing system to achieve RAOs. The remedy described in the Revised RAP proposes SVE/bioventing to reduce COCs in soil not removed by excavation. SVE/bioventing will relatively quickly remove the volatile and most leachable TPH and VOC fractions from the vadose zone over the entire Site. Shell's assessment of joint operation of SVE and bioventing leads to a conclusion that the time frame to achieve remedial goals in Site soils	Revised FS Section 6.2.2.4 Revised RAP Sections 8.2 and 8.4

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			will be approximately to 30 to 40 years. With respect to groundwater, analysis of data indicates the benzene plume is stable or decreasing, and is currently close to or below MCLs near the downgradient property boundary. Modeling predicts that benzene will meet MCLs in Site groundwater within approximately 70 years using MNA assuming source reductions proposed in the RAP and that agencies are successful in stopping off-Site migration of COCs onto the Site. MNA could be paired with contingency groundwater remediation of oxidant injection in areas where Site-related COCs exceed 100x MCL if, after a five-year review following start of SVE/bioventing operations, the groundwater plume is not stable or decreasing.	
RWQCB-14	Page 10 SVE/Bioventing, LNAPL Removal and Monitored Natural Attenuation Numbered Paragraph 2	*The RAP proposes LNAPL removal in wells where it accumulates to a depth exceeding 0.5 feet. LNAPL removal has been on-going at the Site for approximately three years. Although free product removal can be an effective technology for removing waste at some cleanup sites, the mass of product removed to date at the Site is a small percentage of the total waste mass remaining at the Site. Consequently, the Regional Board cannot conclude that free product removal will greatly affect the time*	As part of the remedial actions described in this RAP, LNAPL recovery will continue from wells MW-3 and MW-12 on a monthly basis, and, if LNAPL is detected at a measurable thickness in other wells in the future, monthly LNAPL recovery will be initiated on these wells with sorbent socks or, if they have an LNAPL thickness of greater than 0.5 foot, with a dedicated pump. The goal for LNAPL removal will be no measurable thickness in wells. In addition, in the future Shell proposes to	Revised RAP Section 8.5

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		frame necessary to achieve the SSCGs for groundwater. Further, the Board notes that at other sites in the Los Angeles Region, LNAPL removal to a thickness of a sheen has been shown to be technologically and economically feasible. Consequently, the LNAPL recovery to a thickness of 0.5 feet proposed by the RAP may be less than that which is technologically and economically feasible.	continue to assess the economic and technical feasibility of continued hydraulic recovery of mobile LNAPL using LNAPL transmissivity as a criterion. Details of this approach are listed in the Revised RAP Section 8.5.	
RWQCB-15	Page 10 SVE/Bioventing, LNAPL Removal and Monitored Natural Attenuation Paragraph between Numbered Paragraphs 2 and 3	*The RAP proposes MNA to reduce concentrations of COCs in groundwater to levels that meet applicable water quality objectives where SVE and bioventing are not effective at achieving the objectives. However, there are no studies of MNA at the site to indicate that MNA will be effective in reducing COC concentrations to levels that meet applicable water quality objectives in a reasonable time frame. Review of the past five years of groundwater monitoring data show COC levels fluctuate and there is no discernable trend of COC reduction in most of the monitoring wells. The RAP proposes that Shell will propose additional remedies if MNA is not effective after five years. Although MNA may be an appropriate component of the remedy, the proposed remedy would leave a significant mass of waste in soil that will continue to leach to groundwater. As a result, the time frame for*	As described in the Revised SSCG Report, although some wells may show fluctuating COC concentrations, the current plume at the Site is stable or declining. Currently, the plume is close to or below MCLs near the downgradient property boundary. These conditions are indicative of MNA occurring presently at the Site. MNA is a common approach used at many petroleum release sites in the LA Basin where shallow groundwater is impacted. Together with the mass reduction remedies proposed, MNA is expected to be effective at further reducing the plume to MCLs. It is again noted that SVE/bioventing will relatively quickly remove the most leachable TPH and VOC fractions from the vadose zone over the entire Site, thus limiting the further leaching of these Site-related COCs to	Revised RAP Section 8.4

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		MNA may be excessive. Therefore, the Regional Board cannot conclude that MNA as proposed in the RAP will attain the groundwater SSCGs in a reasonable time frame.	groundwater. Modeling predicts that benzene will meet MCLs in Site groundwater within approximately 70 years using MNA assuming the source reductions proposed in the RAP and that agencies are successful in stopping the off-Site migration of COCs onto the Site. Groundwater within the Site is not being extracted or consumed for any domestic or commercial/industrial purposes. MNA could be paired with contingency groundwater remediation of oxidant injection in areas where Site-related COCs exceed 100x MCL if, after a five-year review following start of SVE/bioventing operations, the groundwater plume is not stable or decreasing.	
RWQCB-16	Page 10 SVE/Bioventing, LNAPL Removal and Monitored Natural Attenuation Numbered Paragraph 3	*The Regional Board is concerned that the RAP does not adequately discuss the siting of the off-gas treatment facilities that will be required to implement the SVE and bioventing technologies. Based on discussions with Shell contractors, Regional Board staff is concerned that it may not be possible to locate off-gas treatment facilities at the Site because it is zoned for residential use. The RAP fails to discuss plans or contingencies for siting the SVE treatment facility if the Site is not available to house an SVE treatment facility.*	Potential offsite SVE system locations are being evaluated in terms of technological feasibility, accessibility and availability of the locations. These potential SVE locations are shown on Figure 8-8. The three offsite locations are on the former Turco Property, the business park located at 24412 So. Main Street, and vacant land north of the MTA/BNSF rail line Shell is currently in discussions with representatives of these three locations regarding access for system installation and operations.	RAP Section 8.2.2 and Figure 8-8

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RWQCB-17	Page 12 Economic Feasibility First Paragraph	*The FS does not provide a complete evaluation of economic feasibility as required by Resolution 92-49. The FS provides cost estimates of alternatives; but does not discuss the incremental benefit of attaining further reductions in the concentrations of COCs compared with the incremental cost of achieving those reductions. The FS provides the costs of remedial excavation alternatives to depths of two feet, three feet, five feet, and ten feet. (See Attachment III). Regional Board staff note that Site data indicate that waste concentrations and mass increase with depth. The Regional Board expects that the incremental costs of excavation at depth are offset by the incremental benefits of reducing the concentrations of COCs. However, the FS failed to conduct an objective balancing of the incremental benefit of attaining further reductions in the concentrations of COCs as compared with the incremental cost of achieving those reductions as required by Resolution 92-49.*	A detailed evaluation of economic feasibility including the incremental benefit of attaining further reductions in the concentrations of COC is provided in the Revised FS. This evaluation includes economic feasibility; nuisance concerns; technological feasibility, implementability, and effectiveness; and time to achieve SSCGs. The economic feasibility evaluation focuses on the incremental benefit compared with incremental cost.	Revised FS Section 6.0 Section 6.2.2.1 Table 6-1

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RWQCB-18	Page 12 Economic Feasibility Second Paragraph	*The UCLA Expert Panel also evaluated the proposed remedy in accordance with Resolution 92-49 and recommended that Shell evaluate excavation alternatives to greater depths to remove a larger fraction of the TPH mass than the estimated 6-8% of the total that would be removed in the alternative proposed by the RAP. (See Attachment II).*	Based on Shell discussions with CP Lai of RWQCB, it appears that the Expert Panel may have incorrectly evaluated and used his calculations in estimating the fraction of TPH mass to be excavated. In the Revised FS Shell has evaluated the TPH mass present at the entire site by depth fraction and estimated the TPH mass to be removed by the various excavation scenarios.	Revised FS Section 5.2.3 Section 6.2.2.1 Table 6-1 Appendix A
RWQCB-19	Page 12 Nuisance Concerns First Paragraph	*The FS does not provide sufficient rationale for the preferred alternative. With regard to the excavation depth, excavation to three feet would not be effective in limiting the exposure of residents to waste below three feet. The three-foot excavation depth alternative relies on institutional controls based on City of Carson Building Code Section 8105 to limit resident exposure to wastes below three feet. However, the City of Carson does not require a building permit for such activities as gardening and landscaping, and excavations to depths greater than three feet does not require heavy equipment. Site data indicate that waste is present in soils at depths of three feet and five feet bgs, so it is reasonable to assume that there is waste present at depths greater than three feet that residents could be exposed to through residential activities such as gardening and building yard*	The Revised FS describes in detail the rationale for selecting the proposed remedy (4D). With respect to the provisions of the Building Code referenced in the comment, please refer to the response to the previous comment RWQCB-12.	Revised FS Section 6.0 Section 7.0

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		features. The Building Code does not apply to excavations that remove less than 50 cubic yards of soil and may not be effective in limiting exposure to wastes in soils below three feet.		
RWQCB-20	Page 13 Technological Feasibility, Implementability and Effectiveness First Paragraph	*The FS consideration of effectiveness and technological feasibility is also deficient regarding excavation depth. By limiting the FS evaluation of excavation depth to the protection of human health only, the FS does not consider the effectiveness of the proposed preferred alternative on abating nuisance and protecting groundwater quality. The FS consideration of feasibility only focuses on the degree of excavation being readily excavated rather than analyzing whether alternative depths are capable of being implemented, effected or accomplished. The FS ignores a Site pilot test that showed that excavating to ten feet is feasible at the Site. The FS's consideration of effectiveness and feasibility as required by Resolution 92-49 is limited and does not provide supporting rationale to concur with the proposed alternative.*	The Revised FS describes in detail the rationale, including compliance with 92-49, for selecting the proposed remedy (Alternative 4D) which includes excavation around houses exceeding soil RAOs to 5 feet, with targeted excavation locally to 10 feet to remove additional hydrocarbon mass.	Revised FS Section 6 Section 6.2.2 Section 7
RWQCB-21	Page 13 Technological Feasibility, Implementability and Effectiveness	*The FS does not evaluate different types of excavation and bases its evaluation of the technological feasibility of excavation on the presence of utilities that are below grade, the constrained areas that may be available*	The Revised FS considers this comment and contains an evaluation of various techniques, including the use of augers to locally excavate soils at the Site to a depth of 10 feet. Use of auger excavation is included in the recommended	Revised FS Section 5 Section 6

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	Second Paragraph	*for excavation, and the need to implement shoring for deeper excavations. However, the Regional Board has overseen remedial excavations in the Los Angeles region where there are underground utilities and has approved deep excavations using technologies that address the issues cited in the FS. The FS fails to consider in detail alternative excavation technologies that may be feasible to justify the technological infeasibility of excavating below three feet bgs. The UCLA Expert Panel Report also suggests that Shell consider alternative technologies, such as use of augers, which would also have the benefit of reducing other impacts associated with excavation (See Attachment II).*	Alternative 4D.	
RWQCB-22	Page 13 Technological Feasibility, Implementability and Effectiveness Third Paragraph	*The FS did not fully evaluate alternatives based on excavating to ten feet bgs in the comparative analysis because this excavation depth was considered "Not Implementable" and thus eliminated from detailed analysis. The Regional Board notes that a pilot excavation was successfully completed at the Site to a depth of ten feet bgs and thereby excavation to ten feet bgs should be considered implementable, and the FS should fully analyze this excavation depth alternative.*	Please refer to the response to the previous comment RWQCB-21	Revised FS Section 5 Section 6

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RWQCB-23	Page 13 Technological Feasibility, Implementability and Effectiveness Fourth Paragraph	*The FS consideration of Overall Protection of Human Health and the Environment is based on long term effectiveness and permanence of the remedy. However, in evaluating overall protection of human health and the environment, the FS does not estimate the waste mass to be removed and the waste mass left on Site as it affects protection of human health and the environment. As discussed above, the waste mass quantity is a key determinant of the period that soil vapor will be generated and the period that soil vapor extraction and bioventing will be required to operate to meet the SSCGs. These technologies may generate COCs to which residents might be exposed over a long time frame. The FS indicates that more than 80 years is required to degrade the hydrocarbons below grade using bioventing. It follows that monitoring and maintenance will be required. The FS fails to note that Resolution 92-49 favors remedies that are permanent and do not require lengthy time frames of monitoring and maintenance which will be required for SVE and bioventing.*	Please refer to the response to the previous comments RWQCB-13, 17, 18, and 20. Also, estimates of hydrocarbon mass removal and the mass of hydrocarbons that would be left in place are included in RAP Section 8.1.3.	
RWQCB-24	Pages 13 and 14 Technological Feasibility,	*It is also noted that bioventing will generate intermediate waste products that will continue to pose risks to residents of the*	Shell is not aware of any studies that have identified a concern that bioventing will results in the generation of intermediate products that may	

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	Implementability and Effectiveness Fourth and Fifth Paragraphs	*Carousel Tract… Additionally, the permanence of bioventing is questionable as intermediate wastes may be generated as hydrocarbons are degraded by bioventing.*	pose a risk to residents. This concern is not raised in State Board or USEPA regulatory guidance on the use of bioventing. This statement fails to recognize that natural biodegradation will degrade intermediate products that may be generated (i.e., bioventing facilitates the degradation process, but will not generate constituents that are not a result of the natural process). Additionally, the cyclic operation of the SVE/bioventing system will mitigate intermediate compounds generated by aerobic biodegradation of petroleum hydrocarbons by extracting these vapors and transporting them to the SVE treatment unit.	
RWQCB-25	Page 14 Technological Feasibility, Implementability and Effectiveness First Paragraph	*SVE and bioventing will require off-gas treatment. The FS does not adequately discuss requirements or feasibility of obtaining a permit to operate a SVE and bioventing system at the Site. It is not clear that such permits are available in residential areas of the South Coast Air Quality Management District. If permits for SVE and bioventing are not available, the effectiveness of the proposed alternative is decreased and issues of long term effectiveness due to the lengthy time frame to reach the SSCGs are exacerbated.*	Shell requested and held meetings with the South Coast Air Quality Management District and Shell's consultants to discuss the possibility of permitting an SVE system in this area well in advance of the March 10, 2014 submittal. The Regional Board was verbally informed of those meetings and their results when they were held. Text was added to explicitly state that "based on preliminary discussions with the SCAQMD, it would be possible to permit a SVE treatment system in a residential neighborhood if risks associated with air emissions are below threshold levels."	RAP Section 8.2.2
RWQCB-26	Page 14 Time to Achieve	*The proposed preferred alternative of excavation to three feet bgs leaves*	The time frame to remediation based on SVE/bioventing was addressed in the previous	Revised FS Section 6.2.2.4

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	SSCGs First Paragraph	*significant waste mass on the Site which must be addressed by bioventing and SVE to achieve SSCGs…Achievement of SSCGs will take a significantly longer time when relying on excavation to three feet bgs than would excavation to deeper depths that will remove a greater mass of waste. The RAP alternative would not be as protective of groundwater quality as alternatives that remove greater mass of waste, since waste will continue to leach from soil to groundwater for a longer time frame. Resolution 92-49 favors cleanups that are permanent and do not require ongoing maintenance and monitoring. The FS fails to consider these factors in its evaluation of alternatives.*	response to comment RWQCB-13. It is expected that the SVE/bioventing system will remove most of the more volatile and leachable fraction of TPH and VOCs in a relatively short time frame (~5 years). However, because an estimated 74% of the Site mass lies beneath 10 feet bgs, there is a negligible difference among the time frames that would be required to remediate this contaminant mass for an excavation to 2 feet, 3 feet, 5 feet, or 10 feet.	
RWQCB-27	Page 14 Time to Achieve SSCGs Second Paragraph	*The FS assesses excavation to three feet to be more implementable than alternatives that involve deeper excavations because fewer properties would be excavated than excavation to depths greater than three feet bgs. The FS notes that cleanup of fewer properties would reduce the time frame of excavation. However, as noted above and by the UCLA Expert Panel, excavation to a lesser depth will prolong the overall length of time to achieve SSCGs. This rationale confuses a less difficult and less extensive cleanup with greater implementability.*	Please refer to the response to the previous comment RWQCB-26.	

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RWQCB-28	Page 14 Time to Achieve SSCGs Third Paragraph	*The FS considers SVE/bioventing as an effective technology for removing and reducing the concentrations of waste that are left after excavation. However, the Bioventing Pilot Test Report determined that time frames of up to 80 years may be required to reduce hydrocarbon concentrations to the SSCGs necessary to protect groundwater at the Site. Resolution 92-49 directs the Regional Board to concur with remedies which the discharger demonstrates, and the Regional Board concurs with, to have a substantial likelihood to achieve compliance within a reasonable time frame. Achieving the SSCGs in a time frame of up to 80 years is not a reasonable time frame because remedial actions would be required to continue in a residential neighborhood for decades, the exposure and nuisance potentials would persist for decades, and waste could continue to leach to groundwater for decades. Resolution 92-49 directs the Regional Board to consider cleanup proposals that implement permanent cleanup and abatement solutions that do not require ongoing maintenance, wherever feasible. The FS does not sufficiently consider alternatives that achieve a permanent remedy that avoids long-term monitoring and maintenance.*	Please refer to the response to the previous comments RWQCB-11 and RWQCB-13.	

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RWQCB-29	Page 15 First Paragraph	*The FS consideration of Overall Protection of Human Health and the Environment is based on long term effectiveness and permanence of the remedy. However, the FS does not estimate the waste mass to be removed and the waste mass left on-site as it affects protection of human health and the environment. As discussed above, the waste mass is a key determinant of the period that soil vapor will be generated and the period that soil vapor extraction and bioventing will be required to operate to meet the SSCGs. These technologies may generate COCs to which residents might be exposed over a long time frame. Consequently, sub-slab mitigation and SVE may need to be operated for a long time frame that is not reasonable. The FS fails to note that Resolution 92-49 favors remedies that are permanent and do not require lengthy time frames of monitoring and maintenance which will be required for SVE and bioventing.*	The Revised FS contains an analysis of the distribution of TPH mass at the Site, as well as an analysis of the TPH mass to be removed under the various excavation scenarios. Also, estimates of hydrocarbon mass removal and the mass of hydrocarbons that would be left in place are included in RAP Section 8.1.3. Approximately 74% of the TPH mass at the Site resides in the 10-50 foot range, and an estimated 88% of the site mass would remain after excavation to 10 feet bgs. Thus, any excavation scenario in the upper 10 feet of the Site will leave substantial mass in place. However, the deeper mass, along with mass not subject to excavation in the upper 10 feet will be remediated through SVE/bioventing. SVE/bioventing is expected to relatively quickly (i.e., approximately 5 years) remove the more volatile and leachable fraction of TPH and other VOCs. Additional excavation depths do not materially shorten this time period. SVE/bioventing is expected to reduce remaining COC concentrations to meet SSCGs in 30 to 40 years of operation. In normal remediation timeframes, a remedy with an O&M period of 30 to 40 years is not uncommon. Again, the Revised RAP proposes excavation around houses exceeding SSCGs to 5 feet, with targeted excavation locally to 10 feet to remove additional mass.	Revised FS Section 5 Section 6 Section 7

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
			Additionally, Shell is prepared to offer installation of a sub-slab mitigation system to any of the homeowners in the Carousel neighborhood to alleviate concerns about potential impact to their indoor air from the Site. The Revised FS addresses 92-49 for all alternatives.	
RWQCB-30	Page 15 Second Paragraph	*In order for the Regional Board to concur with cleanups that attain water quality that is less than background, the alternative cleanup levels must "Be consistent with maximum benefit to the people of the state; not unreasonably affect present and anticipated beneficial use of such water, and not result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and the Regional Water Boards." The FS fails to correctly evaluate consistency with Resolution 92-49 with respect to the effect on groundwater. The FS states that there is no current or future use of the Shallow Zone and Gage aquifer at or near the Site. However, the shallow zone overlays the Gage aquifer in the general area of the Site and the groundwater beneath the Site, which is designated in the Basin Plan with the beneficial use of Municipal and Supply (MUN). As such, impacts on the designated*	Impacts on the designated beneficial use of groundwater were evaluated in the FS as well as in the Revised FS. The proposed remedy (MNA with contingency oxidant injection) is designed to return groundwater to MCLs. This remedy may require 70 years to accomplish. Although this time frame may seem long, the fact remains that Site-related COCs impacts are limited in extent and confined to the Shallow Zone at the Site. Benzene concentrations are at or near MCLs at the downgradient property boundary. Shallow Zone groundwater is not, and will not, be used in the foreseeable future due to non-Site related water quality issues (including high TDS), the restrictions placed on groundwater extraction in the basin, and the lack of space for overlying pumping infrastructure. Groundwater at the site is not currently being consumed. The fact that the Shallow Zone overlies the Gage aquifer is certainly considered and no intention was made in the FS to suggest the Shallow Zone does not bear a MUN beneficial use designation.	Revised FS Section 4.3.10 Section 4.3.11 Section 5.3.5 Section 5.3.6 Revised RAP Section 8.4

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		beneficial uses must be addressed in the remedy.	In consideration of these factors, the Revised RAP proposes a MNA remedy for the Shallow Zone Site related COCs with a contingency oxidant injection. This remedy assumes the agencies will be successful in stopping the migration of COCs from upgradient sources.	
RWQCB-31	Page 15 Conclusion and Directive Number 1 for Revised RAP	*Utilizes approved SSCGs set forth in the Regional Board's letter of January 23, 2014, including attenuation factors for soil vapor.*	The Revised HHRA, Revised FS and Revised RAP have been revised to use the Regional Board–directed and approved soil SSCGs as corrected in their May 29, 2014 correspondence. The Revised HHRA has also been revised to clarify the use of the Regional Board approved soil vapor SSCGs. An updated assessment of the sub-slab soil vapor to indoor air attenuation factor is presented in Appendix D of the HHRA. This updated assessment demonstrates that an attenuation factor of 0.002 is a conservative upper-bound value based on evaluation of the empirical data (i.e., sub-slab and indoor air concentration measurements) collected at the Site.	Revised HHRA Revised FS Revised RAP
RWQCB-32	Page 15 Conclusion and Directive Number 2 for Revised RAP	*Provides estimates of mass proposed to be left in place and bases for estimating the time and cost to reduce the concentrations of constituents of concerns.*	The Revised RAP includes these estimates. Additional details on mass estimation are included in Appendix A of the Revised FS. Cost estimates are also included in the Revised FS Section 6.	Revised RAP Section 8 Revised FS Appendix A Section 6

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
RWQCB-33	Page 15 Conclusion and Directive Number 3 for Revised RAP	*Provides plans for continued monitoring of the Site, including indoor air quality as appropriate if waste is proposed to be left in place.*	A discussion of post-construction monitoring and sampling has been added as Section 8.6 to the Revised RAP. The post-construction sampling plan includes continued sampling of soil vapor probes in streets and utility vaults, SVE/bioventing system operational sampling, soil and soil-vapor sampling for monitoring of SVE/bioventing system effectiveness, sampling of sub-slab soil vapor probes at properties identified for remedial action, screening indoor air for methane with hand-held instruments, and semi-annual groundwater and MNA sampling. Because indoor air concentrations measured during the Phase II investigation are indistinguishable from background levels, effectiveness of the SSD will be assessed only through cross-slab differential pressure measurements. Additional indoor air/sub-slab soil vapor sampling is not necessary to further assess the vapor intrusion pathway following installation of the sub-slab vapor mitigation system; however, additional sub-slab soil vapor monitoring will be performed in accordance with Regional Board directives. Additionally, post-excavation sampling has been included in Section 8.1.7 of the Revised RAP. Costs for this post-construction monitoring were also estimated and included in the Revised FS.	Revised RAP Sections 8.1.7, 8.3.1, and 8.6
RWQCB-34	Page 15 Conclusion and	*Provides a concept rendering of how the cleanup infrastructure will be placed at a*	Plan view and cross-section schematic views of a typical residence soil excavation and	Revised RAP Figures 8-6

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
	Directive Number 4 for Revised RAP	*typical individual residence.*	SVE/bioventing well system installation and soil excavation details have been provided.	and 8-7
RWQCB-35	Page 15 Conclusion and Directive Number 5 for Revised RAP	*Provides a contingent location for SVE/bioventing treatment facility should an on-site location not be available.*	Please refer to the response to the previous comment RWQCB-16.	Revised RAP Section 8.2.2 and Figure 8-8
RWQCB-36	Page 15 Conclusion and Directive Number 6 for Revised RAP	*Revises the calculation of the sub-slab to indoor air attenuation factor and re-identifies properties exceeding the lower bound of risk range of 1x10-6 or a hazard index of 1, based on the more protective SSCG for soil vapor and sub-slab soil vapor for consideration of sub-slab mitigation.*	The Revised HHRA has also been revised to clarify the use of the Regional Board-approved soil vapor SSCGs. An updated assessment of the sub-slab soil vapor to indoor air attenuation factor is presented in Appendix D of the HHRA. This updated assessment demonstrates that an attenuation factor of 0.002 is a conservative upper-bound value based on evaluation of the empirical data (i.e., sub-slab and indoor air concentration measurements) collected at the Site.	Revised HHRA, Appendix D and Section 6.3
RWQCB-37	Page 16 Conclusion and Directive Number 7 for Revised RAP	*Includes an appropriate confirmation sampling plan, with a schedule, of soil, soil vapor, and groundwater to verify the performance of the proposed activities (i.e., Soil Vapor Extraction, Bioventing and Excavation) to document achievement of the Regional Board approved SSCGs for all COCs.*	Post-excavation sampling has been included in Section 8.1.7 of the Revised RAP, and additional post-construction monitoring and sampling has been added as Section 8.6 to the Revised RAP.	Revised RAP Section 8.1.7, Section 8.6

CROSS-REFERENCE TABLE OF REGIONAL BOARD REQUIREMENTS
ADDRESSED IN THE REVISED HHRA, FS, AND RAP
Former Kast Property

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
RWQCB-38	Page 16 Conclusion and Directive Number 1 for Revised FS	*Provides a detailed review of remedial excavation methods that are effective in restricted (i.e. small) areas and can reach depths of ten feet bgs.*	The revised FS contains an evaluation of various techniques, including the use of augers to excavate soils to 10 feet at the Site.	Revised FS Section 5
RWQCB-39	Page 16 Conclusion and Directive Number 2 for Revised FS	*Evaluates alternative active groundwater treatment technologies for site-related COCs should the combination of SVE, bioventing, and MNA prove not to be effective.*	This evaluation is included in the Revised FS.	Revised FS Section 4.3.11 Section 5.3.6
RWQCB-40	Page 16 Conclusion and Directive Number 3 for Revised FS	*Identifies institutional controls that are effective in protecting residents from gardening or small project excavations that may encounter waste left in place.*	The Revised FS evaluates institutional controls.	Revised FS Section 4 Section 5 Section 6
RWQCB-41	Page 16 Conclusion and Directive Number 4 for Revised FS	*Evaluates incremental costs in relation to incremental reduction in waste concentrations in accordance with Resolution 92-49.*	The Revised FS evaluates incremental costs in relation to incremental reduction in TPH mass.	Revised FS Section 6 Sec. 6.2.2 Table 6-1
RWQCB-42	Page 16 Conclusion and Directive Number 5 for Revised FS	*Provides details on post cleanup monitoring for alternatives that leave waste in place.*	A discussion of post-construction monitoring and sampling has been added to the RAP.	RAP Section 8.6
RWQCB-43	Page 16 Conclusion and Directive Number 6 for Revised FS	*Provides off site locations for SVE/bioventing treatment areas.*	Please refer to the response to the previous comment RWQCB-16.	RAP Section 8.2.2 and Figure 8-8

CROSS-REFERENCE TABLE OF REGIONAL BOARD REQUIREMENTS
ADDRESSED IN THE REVISED HHRA, FS, AND RAP
Former Kast Property

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
James C. Carlisle, OEHHA, Human Health Risk Assessment Report, Former Kast Property, Carson, California, Memorandum dated April 29, 2014				
OEHHA-1	Page 1 Comment 1	*The process of eliminating detected chemicals as COPCs should be clearly laid out. A flow chart would be helpful in this regard (see also 4 below).*	Two flow charts have been provided presenting an overview of the COPC selection process for soil and soil vapor.	Revised HHRA, Section 2.2
OEHHA-2	Page 1 Comment 2	*Apparently there are three bases for eliminating detected chemicals as COPCs: a. frequency of detection; b. toxicity screen; and c. comparison with background. Table 4 should include all three criteria and would become much clearer if the reason for exclusion were provided rather than the reason for inclusion.*	The frequency of detection information is provided in the prevalence tables presented in Tables 1 through 3 of the Revised HHRA. Those chemicals that were detected in more than 0.05 % (e.g., more than 5 out of the 10,000 soil samples collected) of the samples were carried into Table 4 for further COC screening. Flow charts outlining the COC screening steps have been added to Section 2.2 of the HHRA report. Table 4 has been revised to include the exclusion rationale as mentioned in OEHHA's comment.	Revised HHRA, Table 4
OEHHA-3	Page 1 Comment 3	*<u>Comparison with background:</u> Page 13 & Table 4 of the main report state that "The results of the one-sample proportion test indicated that cadmium, cobalt, copper, vanadium, and zinc concentrations at the Site are within background". This conclusion seems to contradict the last column of Appendix A Table 5-2 where, in some cases, the answer in is "yes".*	The text has been revised to reflect the information in Table 4. Cadmium, copper, and zinc concentrations at the Site are within background.	Revised HHRA, Section 2.2.3
OEHHA-4	Page 2 Comment 3a	*It appears that if an element passes any one of 4 or 5 screens, it is eliminated. OEHHA believes that the results of the various*	A flow chart was provided summarizing the COC selection process. If a chemical passed the frequency of detection screen, it was further	Revised HHRA Section 2.2

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		analyses should be taken together using a weight-of-evidence approach, rather than a 'pass-one-test-and-you're-out' approach	evaluated with respect to comparison to background (if a metal or carcinogenic PAH evaluated as benzo(a)pyrene equivalents) or 1/10th of the RBSL (all other organic chemicals). The methodology that was followed was the same as used in the Revised SSCG report, just updated with more recent data to confirm no additional chemicals should be included based on the additional data collected since the first HHRA report was submitted. The RWQCB approved the COCs presented in the revised SSCG report with the additional of toluene and xylenes which were added in the HHRA report (March, 2014) and Revised HHRA report.	
OEHHA-5	Page 2 Comment 3b	*Although the use of the one-sample proportion test was approved in a November 21, 2013 OEHHA memorandum, OEHHA is concerned that the test may have been misapplied to the UTL. Using a one-sample proportion test to compare site data to a UTL may bias the analysis in favor of accepting the null hypothesis. It controls the type I error rate at 2 levels (the UTL itself is a UCL on the 95th percentile and then the P value for exceedance of the UTL must be <0.05 to reject the null hypothesis), but does not the type II error rate at all. DTSC (1997) guidance on the subject includes the following: "Metals eliminated as COPC are never again considered in the process of risk*	Geosyntec used the guidance from USEPA on when to use single sample hypothesis tests (ProUCL Version 4.1 User Guide (Draft). Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. USEPA, 2010). The guidance indicates that when the BTVs and cleanup standards are known, one-sample hypotheses including the one-sample proportion test may be used to compare site data with known and pre-established threshold values or BTVs. The ProUCL output files are provided in Appendix 6 of Appendix A in the revised HHRA report.	Revised HHRA, Appendix 6 to Appendix A

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		assessment or risk management. Thus, it is highly desirable to avoid or minimize Type II error in selection of COPC. On the other hand, if a Type I error is made, two subsequent levels of decision-making provide opportunities for correction. Thus, acceptable Type II error should always be less than or equal to Type I error." APPENDIX 6 of Appendix A - "ProUCL Output of One Sample Proportion Test Results" contains no ProUCL output, only a summary thereof. Therefore, OEHHA cannot verify the One Sample Proportion Test Results.		
OEHHA-6	Page 2 Comment 3c	*Arsenic has been eliminated as a COPC at sites where the maximum arsenic concentration is more than twice the BTV and/or exceedances comprise up to 30% of the samples. The probability plot has an apparent deviation from linearity. Since the residential SSCG is 12 mg/kg (Table 11), how can concentrations over 28 mg/kg be left in place? For thallium and antimony, the exceedances are even greater in both magnitude and frequency. This does not appear to be consistent with DTSC (1997, 2005, 2009)*	The use of BTV for evaluating COPCs is based not only on the magnitude of the maximum site concentration but also on the frequency of occurrence. For example, a background control site with a BTV (UCL on the 95th percentile) of 12 mg /kg may have concentrations considerably higher than the BTV, but the frequency of such occurrences shall be below the significance level of 5%. The choice of the commonly used 5% significance level is consistent with the assumption that infrequent occurrences of concentrations higher than the BTV won't incur elevated human and environmental risk. The one-proportion test cited in the guidance uses the population proportion rather than the sample proportion for evaluating the data.	

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
OEHHA-7	Page 2 Comment 3d	*However, the concern regarding exclusion of elements as chemicals of potential concern is mitigated by the fact that the excluded elements are not believed to be site-related.*	Comment noted.	
OEHHA-8	Page 2 Comment 4	*Toxicity screen: Geosyntec compared the maximum concentration of each detected analyte in a given medium to one-tenth of its RBSL. If the maximum concentration was not greater than one-tenth of the RBSL it was eliminated as a COC for the Site. OEHHA is not aware of a prior approval of this screening procedure. This screening procedure could potentially underestimate risk and/or hazard if several chemicals were present at less than, but close to, their respective RBSLs.*	This methodology was used in the Revised SSCG Report (October, 2013). The Water Board provided an approved list of SSCGs for the COCs identified in the Revised SSCG Report with the addition of toluene and xylenes as stated in their January 23, 2014 letter. In addition for the Kast Site, given the former site use, the primary COCs are TPH and petroleum derived VOCS which have been retained for analysis.	
OEHHA-9	Page 3 Exposure Assessment General Comments	1. *Soil exposure assumptions are similar to those in the SSCG document except that exposure to soils up to 5 feet deep is considered on a 350 days/year basis.* 2. *Equation 3.5.3.3 seems to have omitted a term for sub-slab concentration.* 3. *Vapor intrusion is estimated based on a site-wide attenuation factor of 0.002.*	Comments noted. Equation 3.5.3.3 was reviewed and determined to be correct given the use of the EC (Exposure Concentration) term.	No Change.
OEHHA-10	Page 3 Conclusions First Bullet	*Geosyntec has employed additional screens to the determination of COPCs.* o *The concentration / toxicity screen could potentially underestimate combined risk and/or hazard.*	Comments noted, please see response to previous comment OEHHA-8 for concentration/toxicity screen comment.	

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		o *OEHHA initially had some concerns regarding the screening process based on background comparisons, but it appears that this only affects elements that are not site-related.*		
OEHHA-11	Page 3 Conclusions Second Bullet	*OEHHA verified the SSCGs by independent forward risk and hazard calculations and by comparison to previously approved SSCGs.*	Comment Noted.	
UCLA Expert Panel, Review of the HHRA, FS, and RAP, Memo dated April 29, 2014				
Expert-1	Page 3 Human Health Risk Assessment First Paragraph	*The HHRA does address the cumulative nature of multiple constituents of Concern (COCs) within each medium (e.g., soil, soil vapor, etc), but does not address the cumulative or additive effect of the receptor of concern (e.g., residents) exposure to multiple media.*	Cumulative incremental lifetime cancer risk and noncancer hazard estimates have been included in the Revised HHRA.	Revised HHRA Sections 6.3.1.3 and 6.3.2.1 and Tables 19 and 20.
Expert-2	Page 3 Human Health Risk Assessment Second Paragraph	*Geosyntec states that the assessment of indoor air using sub-slab vapor is highly conservative, and therefore they may believe that adding this additional incremental risk is over-protective. However, standard risk assessment guidance (USEPA 1989) states, "The total exposure to various chemicals will equal the sum of the exposures by all pathways." While USEPA (1989) then cautions the reader to not "automatically sum risk from all exposure pathways*	Cumulative incremental lifetime cancer risk and noncancer hazard estimates have been included in the Revised HHRA.	Revised HHRA Sections 6.3.1.3 and 6.3.2.1 and Tables 19 and 20.

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		evaluated for a site", it does state, "two or more pathways should be combined for a single exposed individual or group of individuals." Given the HHRA evaluated the site data on a property basis, one would expect the receptor exposed to the property soil would be the same receptor exposed to indoor air. USEPA (1989)[1] does recognize that the same individuals may not consistently face the "reasonable maximum exposure" for more than one pathway, and the HHRA does allude to this issue in the uncertainty section when it states that "HHRA assumptions entail the receptor staying outdoors] or indoors the entire duration of the exposure period. As a result, the estimated incremental cancer risks and noncancer hazards are over-estimated." But note the pathways risks were not combined in the HHRA.		
Expert-3	Page 3 Human Health Risk Assessment Fourth Paragraph	*While the risk assessment process is over-protective in many ways, until the cumulative effects of all pathways are evaluated, there may be properties un-identified that would not be meeting this objective.* ***Recommendation: Assess cumulative impacts across mediums in the HHRA.***	Cumulative incremental lifetime cancer risk and noncancer hazard estimates have been included in the Revised HHRA. Only one property had cumulative risk estimates greater than 1×10-6 (a value of 2×10-6) when the media risks separately were less than 1×10-6. However, this property is already identified for consideration in the Revised FS and Revised RAP due to an exceedance of the SSCG for leaching to groundwater and therefore potential cumulative risks for this property will be addressed as a part	Revised HHRA Sections 6.3.1.3 and 6.3.2.1 and Tables 19 and 20.

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
			of the remedial action for soils.	
Expert-4	Page 4 Feasibility Study and Remedial Action Plan with regard to Human Health Risk Assessment	*The FS and RAP use the HHRA exceedance of risk/hazard in soils to identify properties for soil excavation and exceedance of risk/hazard in indoor air via soil slab vapor evaluation to identify properties for sub-slab vapor intrusion mitigation. As these two pathways are assessed in the HHRA separately, it is possible that there are some properties that may still pose an unacceptable risk based on the cumulative effects.* ***Recommendation: Ensure all possible "hot spots" requiring more extensive remediation have been identified, by assessing cumulative impacts across mediums.***	Please refer to the response to the previous comment Expert-3.	Revised HHRA Sections 6.3.1.3 and 6.3.2.1 and Tables 19 and 20.
Expert-5	Page 4 Risk Management	*The RAP (or FS) does not clearly state that all existing trees and bushes would be removed during excavations. Most homeowners are more attached to their trees than their hardscapes. The homeowner may choose to refuse the remediation if their mature and/or fruit-bearing tree, for example, has to be removed.* ***Recommendation: If trees can be left in place, institutional controls and surface soil capping should be considered to reduce or mitigate exposure.***	As part of RDIP and PSRP preparation, Shell contractors will meet with homeowners, and their legal representatives as appropriate, to obtain necessary information for relocation during remedial implementation and to discuss hardscape and landscape restoration. During this meeting, existing landscape irrigation systems will be documented so that they can be restored as part of landscape restoration. In some cases, Shell may provide alternative landscape restoration from existing conditions if desired and agreed to by the homeowner, or as required by	Revised RAP Section 8.1.3

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
			City Code. If during this meeting the homeowners express a desire that existing landscaping (such as a mature tree or shrubs) or hardscape not be removed from their property, an option will be discussed of leaving landscape elements or hardscape in place with the homeowners agreeing to enter into a Land Use Covenant (deed restriction) that would be recorded with the County Recorder's Office advising of the potential presence of impacted soil beneath hardscaped areas. If the landscaping or hardscape is removed in the future and potentially impacted soils below the area are exposed, they would be managed in accordance with the Surface Containment and Soil Management Plan (Appendix C of the Revised RAP).	
Expert-6	Page 4 Miscellaneous Minor Edits for the HHRA Second Paragraph	*Table 4 - footnote on toluene and xylenes #5 is incorrect as Footnote #5 discusses the additional background analysis to exclude COCs based on the one-sample proportion test.*	A footnote #7 has been added to Table 4 to indicate that "Although not considered as COCs through the screening process, the RWQCB has requested these VOCs to be evaluated as COCs."	Revised HHRA Table 4.
Expert-7	Page 5 Miscellaneous Minor Edits for the HHRA First Paragraph	*Table 5 does not indicate toluene and xylenes are COCs for Soil Vapor, Sub-Slab (though they are marked as such in Table 6). While these analytes would not be selected as COCs using the methodology presented in the table, we recommend that Tables 4 and 5 present the COC screening process*	Table 5 has been revised to indicate that toluene and xylenes are COCs for soil vapor, sub-slab. Flow charts for the COC screening process for soil and soil vapor have also been added to Section 2.2 of the Revised HHRA report.	Revised HHRA Section 2.2.

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		consistently. We would recommend that Table 4 be changed to be consistent with the process described and Table 6 be used to return the analytes to COC list. Using this method of displaying the screening process, the reader would then follow the reasoning of why the analytes are included in the Soil and Soil-Vapor, Sub-Slab categories due to the regulatory request when they actually pass the COC screening process.		
Expert-8	Page 5 Miscellaneous Minor Edits for the HHRA Second Paragraph	*Table 6 - Note the footnote on the toluene and xylenes analytes under the Soil Vapor, Non-Sub-Slab category is incorrect. These analytes are included on the COC list under this category because they **did** meet the criteria of the COC selection screening process.*	The footnote in Table 6 has been corrected.	Revised HHRA, Table 6
Expert-9	Page 5 Miscellaneous Minor Edits for the HHRA Third Paragraph	*Table 6 should acknowledge the soil vapor screening criteria the Regional Board gave for aliphatic ranges and the nuisance concentration.*	Odor-based screening criteria are provided in Table 12, Soil Vapor SSCGs. Table 6 has been modified to include a footnote that odor based concerns are also being considered in the HHRA.	Revised HHRA, Table 12
Expert-10	Page 5 Miscellaneous Minor Edits for the HHRA Fourth Paragraph	*Table 8 should include a definition of Soil vapor to indoor air volatilization factor (VFsv-IA) for consistency.*	Table 8 revised in response to this comment	Revised HHRA, Table 8
Expert-11	Page 5	*Examining the tables, the reviewer is*	For soil, total xylenes were analyzed in all the	No Change.

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
	Miscellaneous Minor Edits for the HHRA Fifth Paragraph	*concerned with the handling of the xylenes. In some cases the xylenes are presented in total (Table 9a), in analytical isomers (Table 5), or in both forms (Table 4 and 6).*	samples with the individual isomers analyzed in a subset of samples such as split samples sent to another laboratory. For soil vapor, only the individual isomers were analyzed. Total xylenes were selected for estimation of noncancer hazard for soil exposures since it was the complete xylene dataset. Supporting tables such as the COC selection presented both.	
Expert-12	Page 5 Miscellaneous Minor Edits for the HHRA Sixth Paragraph	*Table 9a missing VFs on the table for the COCs of 1,2-Dichloroethane, cis-1,2-Dichloroethene, and tert-Butyl Alcohol. Reviewer assumes that the total xylene VFsoil will be used for the xylene isomers if the EPCs are based on the isomers.*	Table 9b has been corrected to show the VFs for the COCs identified. The totally xylene VF was used in the calculations,	Revised HHRA, Table 9b
Expert-13	Page 5 Miscellaneous Minor Edits for the HHRA Seventh Paragraph	*Table 9b does not need VF SV-OA for 1,2-dichloropropane or for 1,3 butadiene.*	Table 9b has been corrected to remove VFsv-oa for these two VOCs.	Revised HHRA, Table 9b
Expert-14	Page 6 Remedial Alternatives and Feasibility Study Analysis Third Paragraph	*Contamination appears to be pooled in certain areas that reflect the original reservoirs. The use of auger technology to get to contamination at 10 bgs in certain "hot spots" may require considerable less disruption of the surface, less soil removed and less truckloads hauled from the site. It is important to consider that a large number of truckloads will have to be removed, which will disrupt daily life in the area, and*	The Revised FS considers and selects Alternative 4D which includes excavation to 5 feet around homes where COCs exceed RAOs and targeted excavation to 10 feet where practicable at areas where constituents are present in significant amounts (i.e., at 10 times the TPH SSCGs for leaching to groundwater or greater than the residual NAPL soil concentration).	Revised FS Section 8 Revised RAP Section 8

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		increase exposure to air pollutants from the exposed soils as well as from truck emissions. Potential impacts are further discussed in Section 4. As indicated by Geosyntec, Alternatives 4D and 5D would provide a greater degree of reduction in impacted soil through excavation, resulting in higher short and long-term effectiveness, and more permanence, and higher reduction of toxicity, mobility and volume.		
Expert-15	Pages 8 and 9 Groundwater Quality Benefits	*The recommended options, 4B or 5B, may remove less than 10% of the TPH mass, leaving >90% of the mass in the ground. This estimate is based on the analysis by the LA RWCB of the total TPH mass present at different depths (Memorandum of March 20, 2014, on TPH Mass Calculation for Subsoil at Kast Property), indicating that the mass is approximately 295,000 lb at 0-2 ft bgs, 650,000 lb at 2-3 ft bgs, 1,740,000 lb at 3-5 ft bgs, and 6,470,000 lb at 5-10 ft bgs.* *Table 1 describes how this mass is distributed as a percentage of the total at different depths bgs.* [see page 9 for Table 1] *Two related aspects of the preferred remediation options, 4B and 5B, are important to note because of their ability to deliver water quality benefits. As noted in*	Please refer to the response to the previous comments RWQCB-18 and Expert-14.	

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		Table 1, while approximately 10% of the cumulative mass is located at 0-3 bgs, the amount that would be excavated in options 4B or 5B is likely to be considerably less because the material that underlies the homes or the public streets will not be removed under these alternatives. Second, the material that would be removed is from the top of the mass, being the furthest from the groundwater resource. Taken together, this suggests that excavation alternatives 4B and 5B are likely to have relatively small impacts on long-term water quality objectives. *If an excavation alternative is being seriously considered by the Board, we recommend requesting that Geosyntec evaluate an additional remediation alternative.* ***Recommendation: Geosyntec should evaluate an excavation alternative at fewer locations than the proposed 183 homes and at greater depths to potentially remove a larger fraction of the TPH in targeted areas.***		
Expert-16	Page 10 Groundwater Quality Benefits	*It would make most sense to take this approach in areas heavily impacted by COCs as shown in Figure 1. The pilot study conducted by Shell demonstrated that*	Please refer to the response to the previous comment RWQCB-21.	

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		excavation to 10 ft is feasible. Any additional excavation alternative that is developed that removes more than 10% of the mass with considerably less land surface disruption would advance water quality goals over the current alternative while imposing considerably less cost on homeowners. *As we discuss below, 4B and 5B represents an expansive excavation effort that may affect upwards of 183 homes, which will very likely impose significant, short-term economic costs on residents, while having nominal impacts on long-term water quality levels. As such, when evaluating this alternative excavation effort, Geosyntec should consider the use of augers to reach some of the contamination at 10 ft bgs, which appears to be pooled in certain areas that reflect the original reservoirs. This technology may require considerably less disruption of the surface, less soil removed and thus less truckloads hauled from the site.* ***Recommendation: Geosyntec should consider the use of augers to reach contamination at 10 ft bgs.*** *It is important to consider that a large*		

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		number of truckloads will have to be removed, which will disrupt daily life in the area, and increase exposure to air pollutants from the exposed soils as well as from truck emissions. The use of augers to reach greater depths might provide a greater degree of reduction in impacted soil through excavation, resulting in higher short and long-term effectiveness, and higher reduction of toxicity, mobility and volume.		
Expert-17	Page 12 Groundwater Quality Benefits	*Whether excavation is warranted depends upon whether the Board believes significant leaching from the TPH mass is likely to continue to occur. This mass may be strongly held by the soils, but we currently have only indirect evidence to support this belief. Such a determination is important since over 60% of the TPH mass is located at 5-10 ft bgs, which would require the more aggressive excavation alternatives to mitigate, and even then would be able to remove only a fraction of this mass due to the needed setbacks from buildings, roads and utilities. (As we discuss below, the excavation options will also impose significant short-term cost on residents.)* *It is uncertain at this point if leaching flow from this TPH mass could be collected and evaluated by remediating groundwater. If this were possible, the magnitude and trends*	The SSCGs for groundwater are generally set at MCLs. The remedy proposed in the Revised RAP is designed to meet these MCLs. Several observations are offered with respect to this comment by the Expert Panel: • Operation of a SVE/bioventing system over the entire site will reduce the volatile and more leachable fractions of TPH and VOCs in a relatively short time frame (5 years). • Additional source reduction will occur from excavation of shallow soils, remediation of LNAPL, and the agencies working to stop the migration of off-Site sources of COCs onto the Site. • MNA is occurring at the Site given the overall stable or decreasing condition of the plume and the low or non-detect	Revised RAP Section 8.4

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		in flow could be evaluated by the Board over time allowing a further assessment of: (1) the basic threat this mass represents to groundwater quality and (2) the need for groundwater remediation as an on-going remedial option. The acceptability of this approach would seem to depend, in part, on whether the Board agrees as Geosyntec asserts there is "... no current or future use of the Shallow Zone and gage aquifer at or near the Site." (p. 12, Feasibility Study, 2014).	concentrations of Site-related COCs at the downgradient property boundary. With the proposed source reduction at the Site, MNA is expected to return the benzene plume to MCLs in approximately 70 years. • Although this time frame may seem long, Shell continues to assert that there is no current or foreseeable future use of the Shallow Zone water at the Site based on the poor water quality (e.g. TDS), the thin nature of the Shallow Zone, the lack of space for pumping infrastructure in the neighborhood due to the area being fully built out, and the restrictions on groundwater pumping imposed by the adjudication of the basin. • The proposed remedy also includes a contingency oxidant injection program in the event MNA is not effective. Thus, the proposed remedy should address any lingering concerns related to groundwater.	
Expert-18	Page 13 Indoor Air Quality	*Based on the extensive on-site testing, no properties exhibited health exceedances for indoor air pollutants. We assume that the 27 properties with sub-slab soil vapor exceedances will be addressed and remediated regardless of the broader*	Comment noted. The current data indicate that indoor air quality within the community is indistinguishable from background concentrations and as a result the excavation scenarios considered in the FS do not	

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		remediation alternative selected for the tract. As a result neither of the more preferred remediation options, 4B or 5B, will significantly contribute to compliance with air quality regulations within residences. Indeed, this is true of the other considered remediation alternatives as well.	differ in reference to contribution to indoor air quality. While the data collected at the Site do not indicate that vapor intrusion is an issue at any of the residences, Shell is prepared to offer installation of a sub-slab mitigation system to any of the homeowners in the Carousel neighborhood to alleviate concerns about potential impact to their indoor air from the Site.	
Expert-19	Page 13 Utility Workers	*Other important health exposures reductions could arise from utility workers excavating in the 0-3 ft bgs area. Utility-specific institutional controls might mitigate some or all of these exposures. (Recall that this 0-3 ft bgs is the least contaminated zone of the three zones evaluated. See Figure 2 above.) In the absence of institutional controls, these exposures would remain a concern for all remediation alternatives except for alternatives 2 and 3. This is because all options under alternatives 4 and 5 requires setbacks for homes, streets and utilities. As result, they would leave impacted soils directly under and proximate to the foundation of the homes, streets and utilities infrastructure. All subsurface utilities repairs or replacement will likely disturb these areas unexcavated under and proximate to these homes, streets and utility infrastructure. As a result any potential risks*	Anyone performing excavation is required by law to notify the Underground Service Alert one-call system. Additionally, Shell's contractors are, and would continue to be, set up within the (USA) one-call system to receive notification of planned excavation work in the Carousel Tract under the proposed remedy. Upon notification of planned excavations, Shell or their contractors would coordinate with the entity that contacted USA (whether the homeowner or their representative, a homeowner's contractor, or utility company such as Cal-Water, Southern California Gas Company, or AT&T) to provide monitoring and management and handling of residual soils during excavation activities. Additionally, field support has been provided to individual homeowners and their contractors when they have notified Shell of planned activities on their properties, such as plumbing repairs, driveway replacement, and landscaping improvements.	Revised RAP, Section 4.2, Appendix C

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		to utility workers would not be significantly abated by alternatives 4B and 5B.	Field support activities include monitoring for organic vapors, collection and analysis of soil samples when potential impacts are identified in excavations, and coordination with appropriate contractors for proper disposal of the excavated soils. These activities will continue as discussed in the Surface Containment and Soil Management Plan (Appendix C).	
Expert-20	Page 13 Clean Soil as "Protective Barrier" in Alternative 4 and 5	*Although the proposed excavation alternatives represented by 4 and 5 may provide a perceived "protective barrier" to residents, this is may only be true for the portions of the lot landscaped (5) or hardscaped and landscaped (4), under which impacted soils would be excavated. However, for alternatives 4 and 5, unexcavated soils will remain under buildings, streets, and utility infrastructure and, due to setbacks at greater excavation depths, also potentially adjacent to these structures. As a result, we suggest that the benefits of these alternatives in offering a protective buffer to individuals within their homes are more limited than may be initially perceived.*	The proposed remedy, Alternative 4D, would excavate to 5 feet bgs with targeted deeper excavation to 10 feet bgs which is expected to be protective against inadvertent resident contact to soils exceeding the RAOs. The possibility of exposure to soils remaining below 5 feet bgs and impacted soils beneath City streets and sidewalks is addressed through existing institutional controls that require a Grading Permit be issued by the City of Carson for excavations deeper than 3 feet and a Surface Containment and Soil Management Plan to address notifications, management, and handling of residual soils that are impacted by COCs at concentrations greater than risk-based levels. This plan is included in Appendix C to the RAP. In addition, it is important to emphasize that SVE/bioventing will address COCs in Site soils and soil vapor not addressed by the proposed excavation to 5 feet and locally bgs from 5 to 10 feet bgs.	Revised FS Report Section 5 Section 6 Revised RAP Section 4.2

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
			Additional detail is provided in Section 4.2 of the RAP: "Support to Utility Excavations and Homeowners' Activities".	
Expert-21	Page 14 Residential Interim Use Value and Nuisance Losses	*The preferred option in the Remedial Action Plan, 4b, will involve the excavation of soils down to 3 ft bgs under all landscaping for potentially up to 183 homes. Although this is the least intrusive of the excavation depth alternatives considered, it is still likely to impose significant, and on occasions, acute costs to some residents over the period of remediation. The deeper excavation alternative, which would take longer, requires more structural safeguards, and require more on-site activity, would impose even larger social costs of the sort discussed later in this section. While the duration of this period of remediation is uncertain, and depends on the coordination of numerous stakeholders, it is likely to take several years to fully complete for the entire neighborhood.* *Over this period, some residents may experience the interim lost use value from their residences and experience welfare losses associated with nuisance of on-site and neighborhood excavation and soil removal and replacement. These economic factors need to be taken into consideration*	The Revised RAP and the Revised FS discuss the balancing of factors associated with the various alternatives, and these factors and the environmental impacts of the various alternatives will be further analyzed during the CEQA process. The Revised FS analyzes the longer duration and presence of vehicles, open excavations and other activity associated with greater excavation depths/extent. Odor and noise abatement measures are identified in the Revised FS and Revised RAP. The Preliminary Relocation Plan discusses the efforts to minimize the construction-related impact on residents and alleviate these interim impacts, and property-specific implementation of the remedy, site restoration, and mitigation measures will be discussed in the RDIP and the individual PSRPs. These considerations will be further evaluated as part of the CEQA EIR.	

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		when evaluating Resolution 92-49. These impacts could include the following: ***Air pollution exposures.*** *Excavation and soil transportation will likely lead to a substantial increase in interim risk of air pollution exposure to residents, since the contaminated soils will be exposed during excavation and heavy equipment and trucks will be operated during the removal and replacement of soils.* *In particular, particulate matter levels could increase during excavation. Particle pollution contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems, including increased respiratory symptoms such as irritation of the airways, coughing or difficulty breathing. People with heart or lung diseases, children and older adults are most likely to be affected by particle pollution exposure. However, even if you are healthy, one may experience temporary symptoms from exposure to elevated levels of particle pollution. There could be economic costs associated with health impacts, including the cost of medical care and medication.*		

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		Noise and odor nuisances. *Similarly, excavation and soil removal will likely lead to a substantial level of noise impacts associated with truck trips and the operation of heavy equipment. Odor associated with diesel pollution from the trucks, soil disturbances and other processes could also be expected during an interim period. There could be economic costs associated with mental health impacts from noise and odor nuisances.* ***Loss of trees/shrubs, interim loss of landscaping and other aesthetic impacts.*** *Preferred option 4b would involve excavation below landscape and thus would require the permanent loss of favored existing tree or scrubs. After the excavation period, new trees or other plants would have to be planted and landscaping would have to be redone by the property owners. During the exaction period, there would be an interim loss of recreational space for children and pets. There would also be an interim loss of access to other yard amenities such as pools, sheds, gardens, etc. This could affect property value.* ***Impacted ability of residents to sell their properties.*** *While it would be speculative to predict an exact impact on property values,*		

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		excavation activities are likely to depress home values during the period of excavation, given the disturbance. ***Intangible costs associated with temporary household displacement.*** *Interim relocation costs are likely to be highest for households with children and the elderly. Relocation could affect children's ability to attend their regular school and participate in their normal extracurricular activities. Relocation could also affect access to residents' places of employment, childcare, medical care, etc.* ***Possible short-term loss of utility services.*** Excavation below hardscapes and landscaped areas will be complicated by utility lines. Some lines may even have to be removed or temporarily unserviceable.		
Expert-22	Page 15 Benefits to Long-Run Real Estate Values	*The relative real estate impacts to home owners are unknown for those remediation alternatives that might significantly alter the property such as alternative 2, 3 and 6.* *For the remediation alternatives 4 and 5, despite the short-term interim use losses that are possible, we would expect the long-term value of the real estate to return to pre-investigation levels assuming the following:* *1. All sub-slab soil vapor concerns are*	Shell agrees that, after implementation of Alternative 4D, the long-term real estate value of Carousel residences is not expected to be negatively affected. Published sales prices for Carousel residences during recent years remain strong. The Revised RAP and Revised FS discuss the balancing of factors associated with the various alternatives, and these factors and the environmental impacts of the various alternatives will be further analyzed during the CEQA	

Comment No.	Regulatory Comment Page Number and Section	Regulatory Comments	Response	Revised Section(s)
		resolved and in full compliance with guidelines. 2. *Indoor air quality remains in compliance with accepted exposure guidelines for the subsurface pollutants and their derivatives.* 3. *Ground surface environmental health conditions related to subsurface conditions are non-compliant with current regulations which affect the properties residential use value.* 4. *Documented or anticipated environmental liabilities associated with subsurface conditions are mitigated.* 5. *Threats of future potential losses of interim use value are eliminated.* 6. *Local nuisance impacts (e.g., air pollution, dust, noise, odor, loss of utility services, road congestion, etc) from nearby land uses and remediation activities have ceased.*	process.	

APPENDIX B

SECOND QUARTER 2014 GROUNDWATER MONITORING RESULTS

TABLE B-1
Second Quarter 2014 Groundwater Monitoring Results
Shallow Zone (Water Table) Wells
VOCs and Hydrocarbons

LOCATION NAME			MW-01	MW-02	MW-04	MW-05	MW-06	MW-07	MW-08	MW-09	MW-10	MW-11	MW-13	MW-14	MW-15	MW-16	MW-17
SAMPLE DATE			4/24/2014	4/24/2014	4/23/2014	4/25/2014	4/25/2014	4/25/2014	4/25/2014	4/22/2014	4/24/2014	4/22/2014	4/25/2014	4/24/2014	4/23/2014	4/22/2014	4/24/2014
SAMPLE NAME			MW-01	MW-02	MW-04	MW-05	MW-06	MW-07	MW-08	MW-09	MW-10	MW-11	MW-13	MW-14	MW-15	MW-16	MW-17
SAMPLE DELIVERY GROUP (SDG)	Method	Unit	14-04-1832	14-04-1832	14-04-1729	14-04-1979	14-04-1979	14-04-1979	14-04-1979	14-04-1614	14-04-1832	14-04-1614	14-04-1979	14-04-1832	14-04-1729	14-04-1614	14-04-1832
1,1,2-Trichloroethane	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	**2.0J**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	SW8260B	µg/L	**23**	< 1.0	**2.3**	**4.7J**	**5.7**	**18**	**4.1**	< 1.0	**3**	< 1.0	< 5.0	**0.35J**	**2.5**	< 1.0	**0.38J**
1,1-Dichloroethene	SW8260B	µg/L	**53**	< 1.0	**7.5**	**8.5**	**7.9**	**50**	**14**	< 1.0	**11**	< 1.0	< 5.0	**4.1**	**7.3**	< 1.0	**0.67J**
1,2,3-Trichloropropane	SW8260B	µg/L	< 5.0	< 5.0	< 5.0	< 25	**2.0J**	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 25	< 5.0	< 5.0	< 5.0	< 5.0
1,2,4-Trimethylbenzene	SW8260B	µg/L	< 1.0	**5.7**	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**2.5J**	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	SW8260B	µg/L	**4.1**	< 0.50	< 0.50	< 2.5	< 0.50	**0.56**	**0.32J**	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.50	< 0.50
1,3,5-Trimethylbenzene	SW8260B	µg/L	< 1.0	**0.75J**	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**15**	**1**	< 1.0	< 1.0	< 1.0
Acetone	SW8260B	µg/L	< 20	< 20	< 20	< 100	**13J**	**13J**	< 20	< 20	< 20	< 20	< 100	< 20	< 20	< 20	< 20
Benzene	SW8260B	µg/L	**1.3**	**7.3**	**1.3**	**2.5J**	**150**	**0.68**	**3.3**	< 0.50	**9.7**	< 0.50	**510**	**130**	**2.1**	< 0.50	**36**
Chlorobenzene	SW8260B	µg/L	**0.29J**	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0
cis-1,2-Dichloroethene	SW8260B	µg/L	**1000**	< 1.0	**130**	**42**	**97**	**130**	**82**	< 1.0	**90**	< 1.0	**69**	**41**	**36**	< 1.0	**280**
Cumene (Isopropylbenzene)	SW8260B	µg/L	< 1.0	**0.75J**	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**15**	**1**	< 1.0	< 1.0	< 1.0
Diisopropyl Ether (DIPE)	SW8260B	µg/L	< 2.0	< 2.0	< 2.0	< 10	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 10	< 2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene	SW8260B	µg/L	< 1.0	**5**	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**100**	**8.2**	< 1.0	< 1.0	< 1.0
Methyl-tert-Butyl Ether	SW8260B	µg/L	**0.33J**	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	SW8260B	µg/L	< 10	< 10	< 10	< 50	< 10	< 10	< 10	< 10	< 10	< 10	**56**	**4.0J**	< 10	< 10	< 10
n-Butylbenzene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**1.3J**	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	SW8260B	µg/L	< 1.0	**2.4**	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0
p/m-Xylene	SW8260B	µg/L	< 1.0	**14**	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**2.1J**	< 1.0	< 1.0	< 1.0	< 1.0
p-Isopropyltoluene	SW8260B	µg/L	< 1.0	**0.38J**	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0
Propylbenzene	SW8260B	µg/L	< 1.0	**0.83J**	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**14**	**0.80J**	< 1.0	< 1.0	< 1.0
sec-Butylbenzene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 5.0	**0.33J**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**1.9J**	< 1.0	< 1.0	< 1.0	< 1.0
tert-Butyl Alcohol (TBA)	SW8260B	µg/L	< 10	< 10	**8.8J**	< 50	**24**	**14**	< 10	< 10	**26**	< 10	**28J**	**5.2J**	< 10	< 10	**9.6J**
Tetrachloroethene	SW8260B	µg/L	**2.7**	< 1.0	< 1.0	< 5.0	< 1.0	**1.6**	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0
trans-1,2-Dichloroethene	SW8260B	µg/L	**23**	< 1.0	**5**	**8.9**	**22**	**0.59J**	**0.99J**	< 1.0	**2.9**	< 1.0	**5.3**	**1.3**	**1.6**	< 1.0	**10**
Trichloroethene	SW8260B	µg/L	**5.9**	< 1.0	< 1.0	**920**	**0.49J**	**3.3**	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	**1.3**	< 1.0	< 1.0
Vinyl Chloride	SW8260B	µg/L	**0.37J**	< 0.50	**2.9**	< 2.5	**0.49J**	**0.38J**	< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.50	< 0.50
Xylenes, Total	SW8260B	µg/L	< 1.0	**17**	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**2.1JA**	< 1.0	< 1.0	< 1.0	< 1.0
Carbon Chain C25-C28	SW8015B	µg/L	< 50	**26J**	< 48	**20J**	**17J**	< 48	< 48	< 48	**42J**	< 48	**77**	**40J**	< 48	< 48	< 50
Carbon Chain C29-C32	SW8015B	µg/L	< 50	**19J**	< 48	**9.4J**	< 48	< 48	< 48	< 48	**26J**	< 48	**52**	**27J**	< 48	< 48	< 50
Carbon Chain C33-C36	SW8015B	µg/L	< 50	**13J**	< 48	< 48	< 48	< 48	< 48	< 48	**14J**	< 48	**32J**	**18J**	< 48	< 48	< 50
Carbon Chain C37-C40	SW8015B	µg/L	< 50	< 50	< 48	< 48	**8.9J**	< 48	< 48	< 48	< 50	< 48	**12J**	**9.3J**	< 48	< 48	< 50
Carbon Chain C41-C44	SW8015B	µg/L	< 50	< 50	< 48	< 48	< 48	**15J**	< 48	< 48	< 50	< 48	< 48	< 50	< 48	< 48	< 50
Total Petroleum Hydrocarbons (C6-C44)	SW8015B	µg/L	< 50	**260**	< 48	**150**	**460**	**370**	**180**	< 48	**420**	< 48	**2900**	**520**	< 48	< 48	< 50
TPH as Gasoline	SW8015B	µg/L	**360HD**	**290HD**	**100HD**	**290HD**	**510HD**	< 50	**160HD**	< 50	**98HD**	< 50	**1600HD**	**240HD**	**92HD**	< 50	**160HD**
TPH as Diesel	SW8015B	µg/L	**34HDJ**	**220HD**	**42HDJ**	**110HD**	**400HD**	**410HD**	**200HD**	< 48	**390HD**	< 48	**2600HD**	**420HD**	**59HD**	**41HDJ**	**42HDJ**
TPH as Motor Oil	SW8015B	µg/L	< 250	**220HDJ**	< 240	< 240	**210HDJ**	**250HD**	< 240	< 240	**330HD**	< 240	**1300HD**	**350HD**	< 240	< 240	< 250

Notes:
Bold indicates results above lab reporting limit
ug/L = micrograms per liter
J = Estimated value; result between MDL and RL
JA = Estimated value
HD = Chromatographic pattern inconsistent

TABLE B-2
Second Quarter 2014 Groundwater Monitoring Results
Gage Wells
VOCs and Hydrocarbons

LOCATION NAME			MW-G01D	MW-G01S	MW-G02D	MW-G02D	MW-G02S	MW-G03D	MW-G03S	MW-G04D	MW-G04S
SAMPLE DATE			4/22/2014	4/22/2014	4/21/2014	4/21/2014	4/23/2014	4/22/2014	4/23/2014	4/21/2014	4/23/2014
SAMPLE NAME			MW-G01D	MW-G01S	MW-G02D	MW-G02D-DUP	MW-G02S	MW-G03D	MW-G03S	MW-G04D	MW-G04S
SAMPLE DELIVERY GROUP (SDG)	Method	Unit	14-04-1614	14-04-1614	14-04-1535	14-04-1535	14-04-1729	14-04-1614	14-04-1729	14-04-1535	14-04-1729
1,1,2-Trichloroethane	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	SW8260B	µg/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,2,4-Trimethylbenzene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	SW8260B	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	**1.7**	< 0.50	**3**	< 0.50	< 0.50
1,3,5-Trimethylbenzene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	SW8260B	µg/L	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Benzene	SW8260B	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	**0.19J**	< 0.50	**0.24J**	< 0.50	**120**
Chlorobenzene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis-1,2-Dichloroethene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**12**	< 1.0	< 1.0
Cumene (Isopropylbenzene)	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Diisopropyl Ether (DIPE)	SW8260B	µg/L	< 2.0	< 2.0	< 2.0	< 2.0	**2**	< 2.0	**0.48J**	< 2.0	< 2.0
Ethylbenzene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**0.50J**
Methyl-tert-Butyl Ether	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	SW8260B	µg/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
n-Butylbenzene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p/m-Xylene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p-Isopropyltoluene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Propylbenzene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
sec-Butylbenzene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
tert-Butyl Alcohol (TBA)	SW8260B	µg/L	< 10	< 10	< 10	< 10	**15**	< 10	**46**	< 10	**160**
Tetrachloroethene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**0.25J**
trans-1,2-Dichloroethene	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**0.69J**	< 1.0	< 1.0
Trichloroethene	SW8260B	µg/L	< 1.0	**0.89J**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	SW8260B	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50

Notes:
Bold indicates results above lab reporting limit
ug/L = micrograms per liter
J = Estimated value; result between MDL and RL
HD = Chromatographic pattern inconsistent

TABLE B-2
Second Quarter 2014 Groundwater Monitoring Results
Gage Wells
VOCs and Hydrocarbons

LOCATION NAME			MW-G01D	MW-G01S	MW-G02D	MW-G02D	MW-G02S	MW-G03D	MW-G03S	MW-G04D	MW-G04S
SAMPLE DATE			4/22/2014	4/22/2014	4/21/2014	4/21/2014	4/23/2014	4/22/2014	4/23/2014	4/21/2014	4/23/2014
SAMPLE NAME			MW-G01D	MW-G01S	MW-G02D	MW-G02D-DUP	MW-G02S	MW-G03D	MW-G03S	MW-G04D	MW-G04S
SAMPLE DELIVERY GROUP (SDG)	Method	Unit	14-04-1614	14-04-1614	14-04-1535	14-04-1535	14-04-1729	14-04-1614	14-04-1729	14-04-1535	14-04-1729
Xylenes, Total	SW8260B	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon Chain C6	SW8015B	µg/L	< 48	< 48	< 50	< 50	**11J**	< 48	**6.4J**	< 50	**58**
Carbon Chain C7	SW8015B	µg/L	< 48	< 48	< 50	< 50	< 48	< 48	< 48	< 50	**15J**
Carbon Chain C8	SW8015B	µg/L	< 48	< 48	< 50	< 50	**11J**	< 48	**12J**	< 50	**30J**
Carbon Chain C9-C10	SW8015B	µg/L	< 48	< 48	< 50	< 50	**27J**	< 48	**24J**	< 50	**47J**
Carbon Chain C11-C12	SW8015B	µg/L	< 48	< 48	< 50	< 50	**18J**	< 48	< 48	< 50	**21J**
Carbon Chain C13-C14	SW8015B	µg/L	< 48	< 48	< 50	< 50	**22J**	**16J**	< 48	< 50	**17J**
Carbon Chain C15-C16	SW8015B	µg/L	< 48	< 48	< 50	< 50	**23J**	< 48	< 48	< 50	< 48
Carbon Chain C17-C18	SW8015B	µg/L	< 48	< 48	< 50	< 50	< 48	< 48	< 48	< 50	< 48
Carbon Chain C19-C20	SW8015B	µg/L	< 48	< 48	< 50	< 50	< 48	< 48	< 48	< 50	< 48
Carbon Chain C21-C22	SW8015B	µg/L	< 48	< 48	< 50	< 50	< 48	< 48	< 48	< 50	< 48
Carbon Chain C23-C24	SW8015B	µg/L	< 48	< 48	< 50	< 50	< 48	< 48	< 48	< 50	< 48
Carbon Chain C25-C28	SW8015B	µg/L	< 48	< 48	< 50	< 50	< 48	< 48	< 48	< 50	< 48
Carbon Chain C29-C32	SW8015B	µg/L	< 48	< 48	< 50	< 50	< 48	< 48	< 48	< 50	< 48
Carbon Chain C33-C36	SW8015B	µg/L	< 48	< 48	< 50	< 50	< 48	< 48	< 48	< 50	< 48
Carbon Chain C37-C40	SW8015B	µg/L	< 48	< 48	< 50	< 50	< 48	< 48	< 48	< 50	< 48
Carbon Chain C41-C44	SW8015B	µg/L	< 48	< 48	< 50	< 50	< 48	< 48	< 48	< 50	< 48
Total Petroleum Hydrocarbons (C6-C44)	SW8015B	µg/L	< 48	< 48	< 50	< 50	**110**	< 48	< 48	< 50	**190**
TPH as Gasoline	SW8015B	µg/L	< 50	< 50	< 50	< 50	**49J**	< 50	**50**	< 50	**280HD**
TPH as Diesel	SW8015B	µg/L	< 48	< 48	< 50	< 50	**110HD**	**41HDJ**	**59HD**	< 50	**89HD**
TPH as Motor Oil	SW8015B	µg/L	< 240	< 240	< 250	< 250	< 240	< 240	< 240	< 250	< 240

Notes:
Bold indicates results above lab reporting limit
ug/L = micrograms per liter
J = Estimated value; result between MDL and RL
HD = Chromatographic pattern inconsistent

TABLE B-3
Second Quarter 2014 Groundwater Monitoring Results
Shallow Zone (Water Table) Wells
General Minerals and Metals

LOCATION NAME			MW-01	MW-02	MW-04	MW-05	MW-06	MW-07	MW-08	MW-09	MW-10	MW-11	MW-13	MW-14	MW-15	MW-16	MW-17
SAMPLE DATE			4/24/2014	4/24/2014	4/23/2014	4/25/2014	4/25/2014	4/25/2014	4/25/2014	4/22/2014	4/24/2014	4/22/2014	4/25/2014	4/24/2014	4/23/2014	4/22/2014	4/24/2014
SAMPLE NAME			MW-01	MW-02	MW-04	MW-05	MW-06	MW-07	MW-08	MW-09	MW-10	MW-11	MW-13	MW-14	MW-15	MW-16	MW-17
SAMPLE DELIVERY GROUP (SDG)	Method	Unit	14-04-1832	14-04-1832	14-04-1729	14-04-1979	14-04-1979	14-04-1979	14-04-1979	14-04-1614	14-04-1832	14-04-1614	14-04-1979	14-04-1832	14-04-1729	14-04-1614	14-04-1832
Antimony	SW6020	mg/L	**0.000284J**	**0.000108J**	**0.000211J**	**0.000144J**	**0.000203J**	**0.00029J**	< 0.001	**0.000123J**	**0.000125J**	**0.000209J**	**0.000223J**	< 0.001	**0.000212J**	**0.000174J**	**0.000126J**
Arsenic	SW6020	mg/L	**0.000458J**	**0.000998J**	**0.00773**	**0.199**	**0.00892**	**0.00232**	**0.102**	**0.000523J**	**0.00205**	**0.00456**	**0.0453**	**0.00126**	**0.0952**	**0.000946J**	**0.00199**
Barium	SW6020	mg/L	**0.0961**	**0.121**	**0.236**	**0.165**	**0.445**	**0.296**	**0.478**	**0.145**	**0.507**	**0.169**	**0.588**	**0.171**	**0.142**	**0.159**	**0.0647**
Beryllium	SW6020	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	SW6020	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.000138J**
Chromium	SW6020	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.000501J**	< 0.001	< 0.001	**0.00163**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	SW6020	mg/L	**0.000733J**	**0.000502J**	**0.000952J**	**0.000786J**	**0.000646J**	**0.00207**	**0.000706J**	**0.000571J**	**0.000826J**	**0.000565J**	**0.00113**	**0.000566J**	**0.000594J**	**0.000542J**	**0.00126**
Copper	SW6020	mg/L	**0.00609**	**0.00213**	**0.00213**	**0.00256**	**0.00251**	**0.00633**	**0.00195**	**0.00165**	**0.00323**	**0.00152**	**0.00391**	**0.00223**	**0.00174**	**0.00385**	**0.00245**
Lead	SW6020	mg/L	**0.000353J**	**0.0000902J**	**0.000363J**	**0.00088J**	**0.000135J**	**0.000228J**	< 0.001	**0.000136J**	**0.000163J**	**0.000179J**	**0.000268J**	**0.0002J**	**0.000193J**	**0.000214J**	**0.000172J**
Mercury	SW7470A	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	**0.00634**	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Molybdenum	SW6020	mg/L	**0.000902J**	**0.000644J**	**0.000947J**	**0.00781**	**0.00143**	**0.00991**	**0.00544**	**0.00165**	**0.00128**	**0.00231**	**0.000696J**	**0.00189**	**0.00205**	**0.00266**	**0.000232J**
Nickel	SW6020	mg/L	**0.0165**	**0.012**	**0.0119**	**0.0141**	**0.0116**	**0.0296**	**0.0164**	**0.0161**	**0.0187**	**0.0116**	**0.0172**	**0.0159**	**0.0111**	**0.0147**	**0.0153**
Selenium	SW6020	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.000732J**	**0.000234J**	< 0.001	< 0.001	< 0.001	**0.00019J**	< 0.001	< 0.001	< 0.001	**0.00956**
Silver	SW6020	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.00026J**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Thallium	SW6020	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Vanadium	SW6020	mg/L	**0.0009J**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.000684J**	< 0.001	< 0.001	< 0.001	< 0.001
Zinc	SW6020	mg/L	**0.0207**	**0.0116**	**0.0289**	**0.0154**	**0.0113**	**0.014**	**0.0385**	**0.0171B**	**0.00944**	**0.019B**	**0.0145**	**0.0167**	**0.0491**	**0.0148B**	**0.0155**

Notes:
Bold text indicates results above laboratory reporting limit.
mg/L = milligrams per liter
J = Estimated value; the result is betweenthe MDL and the RL
B = Analyte detected in associated blanks

TABLE B-4
Second Quarter 2014 Groundwater Monitoring Results
Gage Wells
General Minerals and Metals

LOCATION NAME			MW-G01D	MW-G01S	MW-G02D	MW-G02D	MW-G02S	MW-G03D	MW-G03S	MW-G04D	MW-G04S
SAMPLE DATE			4/22/2014	4/22/2014	4/21/2014	4/21/2014	4/23/2014	4/22/2014	4/23/2014	4/21/2014	4/23/2014
SAMPLE NAME			MW-G01D	MW-G01S	MW-G02D	MW-G02D-DUP	MW-G02S	MW-G03D	MW-G03S	MW-G04D	MW-G04S
SAMPLE DELIVERY GROUP (SDG)	Method	Unit	14-04-1614	14-04-1614	14-04-1535	14-04-1535	14-04-1729	14-04-1614	14-04-1729	14-04-1535	14-04-1729
Antimony	SW6020	mg/L	0.000761J	0.000214J	0.000261J	0.000409J	0.000224J	0.00056J	0.000189J	0.000149J	0.000288J
Arsenic	SW6020	mg/L	0.00341	0.00255	0.00473	0.00467	0.00312	0.00843	0.00802	0.0046	0.0196
Barium	SW6020	mg/L	0.024	0.126	0.0403	0.0484	0.269	0.0549	0.263	0.0523	0.0355
Beryllium	SW6020	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.000636J	< 0.001	< 0.001	< 0.001
Cadmium	SW6020	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.00028J	< 0.001	< 0.001	< 0.001
Chromium	SW6020	mg/L	< 0.001	0.000602J	< 0.001	< 0.001	< 0.001	0.000776J	< 0.001	< 0.001	< 0.001
Cobalt	SW6020	mg/L	0.000207J	0.000475J	0.00024J	0.000371J	0.000374J	0.000769J	0.000315J	0.000442J	0.000164J
Copper	SW6020	mg/L	0.00128	0.00213	0.000519J	0.00112	0.0015	0.000927J	0.00096J	0.00134	0.0016
Lead	SW6020	mg/L	0.000181J	0.000187J	< 0.001	9.14E-05J	0.000136J	0.000294J	< 0.001	0.000331J	0.000175J
Mercury	SW7470A	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Molybdenum	SW6020	mg/L	0.00131	0.000975J	0.000748J	0.000822J	0.00287	0.00207	0.00177	0.00141	0.00292
Nickel	SW6020	mg/L	0.00794	0.0135	0.00451Bj	0.00842Bj	0.00998	0.0112	0.00961	0.00811B	0.00435
Selenium	SW6020	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Silver	SW6020	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Thallium	SW6020	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.00056J	< 0.001	< 0.001	< 0.001
Vanadium	SW6020	mg/L	0.000218J	< 0.001	0.00044J	< 0.001	< 0.001	0.000689J	< 0.001	< 0.001	0.000331J
Zinc	SW6020	mg/L	0.0779B	0.0312B	0.00366Jb	0.00689b	0.0145	0.0374B	0.00543	0.0247b	0.0192

Notes:
Bold text indicates results above lab reporting limit
mg/L = milligrams per liter
J, j = Noted as estimated by lab or data validation, respectively
B, b = Noted as present in blank by lab or data validation, respectively

APPENDIX C

SURFACE CONTAINMENT AND SOIL MANAGEMENT PLAN

SURFACE CONTAINMENT AND SOIL MANAGEMENT PLAN

INTRODUCTION

URS Corporation (URS) has prepared this Surface Containment and Soil Management Plan (SMP) as part of the Revised Remedial Action Plan (Revised RAP) for the Former Kast Property (Site) in Carson, California on behalf of Equilon Enterprises LLC, doing business as Shell Oil Products US (Shell or SOPUS). The SMP is submitted in accordance with Cleanup and Abatement Order (CAO) No. R4-2011-0046 issued to Shell by the California Regional Water Quality Control Board – Los Angeles Region (RWQCB or Regional Board) on March 11, 2011 and the RWQCB's letter dated January 23, 2014 directing Shell to submit a RAP and Human Health Risk Assessment for cleanup of the Carousel Tract pursuant to California Water Code Section 13304.

The Regional Board is the lead Regulatory Agency for this project; however, the protocols presented in this SMP are intended to apply to all parties involved in soil disturbance activities at the Site (e.g., excavation, landscaping, utility installation), including the City of Carson, County of Los Angeles Department of Public Works, local utility providers, contractors, and residents.

OBJECTIVE

This SMP provides the detailed approach to mitigate potential residential, construction, or utility worker exposure to soils that do not meet Remedial Action Objectives (RAOs) and that may remain at the Site following implementation of the excavation remedy outlined in the Revised RAP and forthcoming Remedial Design Implementation Plan (RDIP). For the purposes of this SMP, these soils will be referred to herein as "residual soils." The SMP details the long-term approach to address potential residual soils should the need arise to disturb these soils in the future. Residual soils may be present at depths below the depth of excavation, as well as in areas not excavated such as beneath homes, City sidewalks and streets.

BACKGROUND

Remediation of soil, soil vapor, and groundwater is required, as approved by the Regional Board, in portions of the Site that do not meet RAOs under existing conditions. In accordance with the CAO, this SMP specifies on-going monitoring requirements for residual soils that will remain in place after remedial excavation. The SMP summarizes protocols for containment, monitoring, and management of such residual soils. This SMP is designed to be used in conjunction with existing administrative controls (e.g., City of Carson and Los Angeles County Codes regarding construction, grading, landscaping, and excavation and encroachment permits).

Site-related constituents of concern (COCs, those COCs associated with the historic use of the Site as an oil storage facility) consist of petroleum hydrocarbon-derived constituents and some metals. In addition, other chemicals have been detected in Site soils that are unrelated to the former Site use as an oil storage facility and are referred to as non-Site-related COCs.

Proposed remedial actions include excavation to 5 feet bgs in landscaped areas of residential properties and areas covered by residential hardscape, including residential planters, walkways, and uncovered patios at properties where RAOs and the more stringent of the health risk-based or leaching to groundwater criteria are not met under existing conditions. Additionally, local targeted deeper excavations from 5 to 10 feet bgs will be conducted at properties in areas where significant additional hydrocarbon mass can be removed. Soil will not be excavated from areas beneath homes, City sidewalks and streets. Excavated areas will be backfilled and landscaping/hardscaping will be restored to like conditions. The backfill and landscaping will provide a protective barrier to minimize the potential for exposure to soils below the depth of excavation. Soils below a depth of 5 feet and soils beneath surface containment features (see below) will be addressed through a combined soil vapor extraction (SVE) and bioventing system that will include installation of SVE/bioventing wells both in City streets and on residential properties where RAOs are not met following soil excavation.

This Soil Containment and Soil Management Plan outlines procedures so that residents or construction/utility workers are not inadvertently exposed to soils that exceed the RAOs for the Site.

SURFACE CONTAINMENT

Physical barriers (e.g., presence of not impacted with COCs that exceed RAOs soil to a depth of 5 feet, hardscape, or structures, and City streets and sidewalks) will serve to contain and/or prevent exposure to underlying impacted soils and will restrict access and exposure to deeper soils. In areas where impacted soils will be excavated to 5 feet bgs, the clean imported soil backfill or controlled low strength materials (CLSM, or sand-cement slurry) will serve as a barrier restricting exposure to underlying soils. Additionally, Site soils that meet RAOs will provide surface containment preventing contact with underlying residual soils. Where soils are not removed as part of the remedial excavation, the existing cover (consisting of concrete foundations and floor slabs of houses, garages, City sidewalks, street pavement, etc.) will provide a protective barrier to minimize the potential for exposure to impacted soil below. Site features, such as homes, garages, City sidewalks, and roads are considered part of the protective barrier.

MANAGEMENT OF RESIDUAL SOILS CONTAINING SITE COCS ABOVE SSCGS

Following remedial excavation, residual soils may remain below 5 feet bgs and beneath homes, garages, streets and City sidewalks. The potential for contact with these residual soils will be mitigated by the surface containment features described above, except in limited instances where excavation deeper than 5 feet may be necessary. Because City Code requires permits for excavations deeper than 3 feet, there is an administrative control already in place to restrict potential contact with these deeper soils (i.e., a permit requirement). This administrative control and notification mechanism is further discussed below.

Based on the distributions of COCs on each property (e.g., Figures 3-3 through 3-14 of this Revised RAP) and the results of post-excavation soil sampling, Shell will have a means to identify soils remaining after remedial excavation and remedial system installation that do not meet RAOs. This will provide sufficient identification of the residual soils remaining at the Site to allow any entity performing future excavations at the Site to anticipate the environmental conditions they may

encounter. It is anticipated that SVE/bioventing will reduce COC concentrations in residual soils to meet RAOs within an estimated 30 to 40 years (see Section 8.2.4 of the Revised RAP).

Administrative Controls

The City of Carson Building Code Section 8105, which amends the L.A. County Building Code Section 7003.1, is an existing institutional control that would limit, through permitting processes, contact with impacted soils beneath a depth of 3 feet. This existing institutional control supports the planned 5-foot soil excavation remedy. Because of this code provision, the City must be notified and approve excavations deeper than 3 feet. The City could readily inform residents and workers of other appropriate precautions necessary for excavations below the 5-foot depth of planned remedial excavation through existing administrative processes, and also notify Shell that monitoring and disposal may be required. Shell would coordinate with the City of Carson to establish a process through existing building and grading permit reviews, General Plan overlay or footnote, area plan, or similar process, to ensure that if a property owner were to conduct activities involving excavations greater than 5 feet deep (such as building renovation, installation of a pool or deeper landscape alterations), Shell would be notified so that the company could arrange for sampling and proper handling of impacted soils.

Because an institutional control is already in place in the City of Carson requiring grading permits in order to excavate at depths below 3 feet, these requirements would not interfere with a homeowner's unrestricted property use and enjoyment. Depending on the selected remedy, LUCs (e.g., restrictive covenants, easements), may also may be appropriate to fully implement remedial alternatives for the Site. Under certain remedial scenarios such as a homeowner requesting that certain landscaping or hardscape not be removed, a new LUC would be required to advise of the residual soils present, but it would not be effective absent homeowner agreement and cooperation.

Anyone performing excavation is required by law to notify the Underground Service Alert (USA) one-call system. Additionally, Shell's contractors are, and would continue to be, set up within the USA one-call system to receive notification of planned excavation work in the Carousel Tract. Upon notification of planned excavations, Shell or their contractors would coordinate with the entity that contacted USA (whether the homeowner or their representative, a homeowner's contractor, or utility company such as Cal-Water, Southern California Gas Company, or AT&T) to provide monitoring and management and handling of residual soils during excavation activities.

Additionally, Shell will implement a community outreach program to inform and educate residents in the community of residual impacted soils and of the notification procedures for management of these materials via the Surface Containment and Soil Management Plan.

Monitoring

A number of types of monitoring may be performed to support excavation activities, depending on the volume and extent of excavation. Appropriate monitoring for dust, odor, and vapors will be conducted. Where required, Shell will offer to perform monitoring if not otherwise being performed by the party doing the work. At a minimum, real-time monitoring of the work area and excavations will be conducted using a photoionization detector (PID) during excavation operations. Monitoring may also be conducted with a flame-ionization detector (FID) for methane in the parts per million by volume (ppmv) range and a four-gas meter for methane in the percent level, oxygen, carbon dioxide,

and hydrogen sulfide. Monitoring for odors may also be conducted based on worker perception, at the downwind property boundary of the residential property where excavation is occurring.

To mitigate offsite dust migration and resultant impacts to neighboring properties, dust monitoring will be conducted for large excavations. If visible dust is encountered, periodic watering of the active excavation areas will be recommended throughout the excavation and backfill activities. In addition to dust suppression efforts, odor suppressants will be recommended to mitigate offsite migration of odors from the work area.

Soils Management

As discussed above, notification through participation in the USA system or City of Carson permit requirements would allow Shell's representatives to collect appropriate samples and arrange for disposal of soil generated from utility work, if appropriate. If excavation of the soil is necessary for residential or utility provider construction activities, it is likely that impacted soil would not be suitable for re-use. If requested by the property owner or utility service provider, Shell would arrange for the removal, transportation, and offsite disposal of impacted soil by a qualified waste contractor. If potentially impacted soil is observed during urgent or emergency construction activities (e.g., a gas line repair), and an authorized representative is not onsite, Shell should be notified as early as possible to allow the material to be profiled and properly disposed. If Site soils are being excavated on an urgent basis, the property owner or contractor should ensure that potentially affected soil is segregated and stockpiled to allow for proper soil profiling and management.

After receiving notification that potentially impacted soil could be encountered during the course of construction activities, Shell would arrange for a contractor to collect samples of the soil (either in situ or from a segregated stockpile) for profiling purposes if an updated waste profile is needed.

To the extent possible, impacted soil would be direct loaded into approved waste containers for transport to the appropriate recycling or disposal facility. With advance notice, Shell would provide suitable containers based on the nature of the excavation work being conducted. In the event that it is necessary to temporarily stockpile soil onsite before loading, soils should be placed upon plastic sheeting and covered with plastic until they could be loaded into approved waste containers to be provided.

Excavated impacted soil would be transported offsite to appropriately licensed recycling/disposal facilities by a state-licensed waste hauler for appropriate recycling or disposal. To the extent possible, soils would be pre-profiled, and approval would be obtained from the recycling/disposal facilities before excavation activities begin. Documentation pertaining to waste disposal profiles and waste disposal acceptance would be in place prior to any offsite shipments of waste.

CONTACTS

Information regarding the implementation of this SMP can be obtained by calling the Regional Water Quality Control Board project manager at the number listed below. Other governmental agencies that may be responsible for implementing the Soil Management Plan include the South Coast Air Quality Management District (SCAQMD), Los Angeles County Department of Public Works, Los

Angeles County Fire Department, Los Angeles County Department of Health, and the City of Carson.

If you have any questions or wish to discuss the project, please contact:

Teklewold Ayalew, PhD, PG
Regional Board Project Manager
(213) 576-6739
tayalew@waterboards.ca.gov

Shell's Kast Community Information Line
(310) 857-2335
info@kastproperty.com

APPENDIX D

PRELIMINARY RELOCATION PLAN

PRELIMINARY RELOCATION PLAN

Introduction

As part of implementation of the Revised Remedial Action Plan (RAP), Shell Oil Products US (SOPUS or Shell) will provide temporary alternative accommodations to eligible residents of properties while remedial actions (in particular remedial excavations) are performed in the yards of their residences, in compliance with recommendations of the Revised Human Health Risk Assessment (Revised HHRA), Revised Feasibility Study (Revised FS), and this Revised RAP, and under the oversight of the Los Angeles Regional Water Quality Control Board (RWQCB or Regional Board). During remedial excavation, backfill, and restoration work, residents of the properties where excavation is conducted will be temporarily relocated as described herein. Following backfill and utility and hardscape restoration, residents would move back into their homes during landscape restoration and fence/block wall construction, or, at their option, wait to return until after the landscape restoration work is completed.

Residents of properties adjacent to locations where excavations are occurring will be offered alternative accommodations if necessary based on the nature of the excavation work, the potential for interruptions of access to the property, or due to disruptions in utility service to the property. Relocation of residents at adjacent or nearby properties will include services and security as described herein.

This is an overview of the Program and the services being offered. If desired by a resident, a Cartus Program counselor will be available to review a resident's particular needs during relocation and present the Program features and options available.

About the Program

The Program is being offered to eligible residents of properties where excavation will be performed that may cause a temporary inconvenience to the residents and necessitate temporary alternative living arrangements during excavation and restoration.

The Program:

- Offers a payment that can be applied towards temporary living expenses for the members of the household living at the residence;
- Provides assistance, if desired, with making temporary living arrangements and/or hotel accommodations billed directly to Cartus, a Shell relocation contractor;
- Provides an inconvenience allowance as part of the payment.

It is anticipated that Cartus, a nationwide real estate services company, will administer the Program.

Alternative accommodations may be offered on a case-by-case basis to residents of neighboring properties to minimize disruptions (due to interruptions of access to the property resulting from

equipment staging, or due to disruptions in utility service to the property, noise, or other conditions) to those residents.

Program Eligibility

Residing owners or tenants of a residential property that qualifies for temporary living arrangements (as determined by Shell or its consultants/contractors as set forth above) due to remediation-related excavation activities are eligible for the Program.

It is a requirement of the Program that the resident sign a "Use of Home and Acknowledgement of Payment to Occupants" form in order to receive program benefits. Please see Attachment A – "Use of Property and Acknowledgement of Payment of Occupants."

Planned Remediation Activities

Overview

As described in the Revised RAP, Shell intends to conduct the following multi-media remedial actions for the Site:

- Excavation of shallow soils to 5 feet below ground surface (bgs) at impacted residential properties where Remedial Action Objectives (RAOs) are not met under existing conditions, and targeted excavation of deeper soils between 5 and approximately 10 feet bgs at certain properties where significant hydrocarbon mass can be reduced based on the distribution and concentration of hydrocarbons detected.
- Following excavation, a combination of soil vapor extraction (SVE) and bioventing will be conducted to address residual petroleum hydrocarbons and volatile organic compounds (VOCs) and methane in soils below the depth of excavation and areas not excavated. . SVE/bioventing wells will be installed in City streets and on residential properties, as appropriate.
- Sub-slab mitigation will be implemented at properties where RAOs are not met based on theoretical calculations of vapor intrusion risk or where methane concentrations in sub-slab soil vapor exceed the upper RAO for methane of 0.5%. In addition, while the data do not indicate that vapor intrusion is an issue at any of the residences, Shell is prepared to offer installation of a sub-slab mitigation system to any of the homeowners in the Carousel neighborhood to alleviate concerns about potential impacts to their indoor air from the Site.

Excavation of soils is the only activity anticipated to require temporary relocation of residents of the affected properties. Based on findings of the Revised Human Health Risk Assessment, Shell will excavate shallow soils at approximately 202 residential properties to a depth of 5 feet below existing grade, and additional targeted excavation of deeper soils between 5 and approximately 10 feet bgs at approximately 82 of those properties, where significant hydrocarbon mass can be reduced based on the distribution and concentration of hydrocarbons detected.

Soils will be excavated from both landscaped areas and areas currently covered by hardscape, including walkways, driveways, patio areas, and hardscape associated with landscaping. Hardscape and landscaping will be removed during the initial stage of excavation and restored to like conditions

following completion of excavation. Shell also anticipates that it may be necessary to remove most fences and block walls between yards and ornamental or partitioning walls on individual properties, as the depth of excavation will exceed footing depths, and removal of fences and walls separating side yards will facilitate equipment access to back yards. As with other hardscape, fences and walls will be restored following completion of excavation along with restoration of landscaping. Exceptions to excavation beneath hardscape include patios covered by structures and roofs, and swimming pools and pool decking surrounding swimming pools. These hardscape areas will not be excavated to avoid structural demolition and potential damage to swimming pools and appurtenant equipment. In addition, property-specific features may limit excavation in some localized areas and this will be considered as the individual Property-Specific Remediation Plans are developed.

Following approval of the RAP, a Site-wide Remedial Design and Implementation Plan (RDIP) will be prepared along with a Property Specific Remediation Plan (PSRP) for each property that requires remedial action. As part of PSRP preparation, Shell contractors will meet with homeowners and/or residents, and their legal representatives, as appropriate, to obtain necessary information for relocation during remedial implementation and to discuss hardscape and landscape restoration.

Remedial excavation is anticipated to proceed in phases, with each phase of work including approximately eight contiguous properties, if access can be obtained. Where possible, each phase will include homes on both sides of a city block (e.g., the east side of Marbella and west side of Neptune Avenues or the west side of Ravenna and east side of Panama Avenues). For properties on the perimeter of the tract, work will likely proceed at a smaller number of properties for each phase. This approach will be used so that back-of-lot and side yard fences or block walls can be removed one time and excavation conducted in both yards before the fences are restored.

Preliminarily, based on working five days per week, it is estimated that excavation and backfill will take approximately six weeks per property and site restoration will take an additional approximately two weeks. Approximately 10 weeks would be needed to complete a phase of eight properties. Thus, residents may be relocated for a period of approximately eight weeks, with potential for shorter or longer durations. Following backfill and utility and hardscape restoration, residents would move back into their homes during landscape restoration and fence/block wall construction, or, at their option, wait to return until after the landscape restoration work is completed. For non-excavated properties adjacent to properties where excavation work is being conducted, residents of adjacent properties and will be offered relocation as necessary.

Temporary Living Assistance

Overview

The goal of the Program is to provide eligible households with financial assistance toward the temporary living expenses that participants may incur due to temporary relocation during remediation activities. In addition, if desired, assistance with temporary living arrangements may be provided.

How the Program Assistance Payment is Established

At least two weeks prior to the relocation date, a meeting will be held with the residents to provide information about financial assistance to facilitate relocation, including relocation or boarding of pets

and assistance with transportation, if needed. Residents will be asked for general information about persons living in the home, such as the number of adults and children and the ages of the children. Special needs, such as long-term vehicle storage, special medical needs, or transportation needs will be discussed and accommodations will be made to ensure the relocation is as comfortable as possible for the residents. Refer to Attachment B for information to be obtained during the interview. Once the interview is completed, a financial assistance calculation will be completed and the residents will be informed of the amount to be provided.

Assistance with Temporary Living Arrangements

Residents will have the option to stay at a hotel of their choice and make their own arrangements subject to the daily payment amounts provided below. If requested, residents may choose to stay at a hotel arranged by and direct billed to Cartus. Available hotels for direct billing include:

- Marriott Residence Inn Torrance, 3701 Torrance Boulevard, Torrance, California;
- Marriott Residence Inn Manhattan Beach, 1700 North Sepulveda Boulevard, Manhattan Beach, California;
- Marriott Courtyard Torrance, 2633 Sepulveda Boulevard, Torrance, California;
- Marriott Residence Inn Downtown Long Beach, 600 Queensway Drive, Long Beach, California; and
- Marriott Residence Inn Long Beach, 4111 East Willow Street, Long Beach, California

In either instance, Shell will pay any pet fees charged by the hotel or pet boarding charges subject to daily limits.

If requested, Cartus can make the initial reservations and will provide contact information at the hotel in case any changes need to be made. In addition, direct billing can be set up for the room, pet fees, and tax. However, all other expenses (meals, etc.) shall be paid directly by the participating residents. Meals and other miscellaneous assistance based on the family profile will be provided in the payment amount. Any damage to hotel rooms, furnishings or other property during relocation periods will be the responsibility of the relocated residents.

Program Payment

The Program will provide eligible participants with assistance towards the temporary living expenses such as lodging and meals that may be incurred as a result of the remediation being completed at their home. The Program payment will be calculated by Cartus and will be communicated after the interview conducted as part of the RDIP and PSRP process.

Payment will be provided in the form of funds loaded onto one debit card per property. As noted above, the resident will need to sign a "Use of Property and Acknowledgement of Payment to Occupants" form in order to receive the payment. Please see Attachment A for further information.

Shell will provide relocated residents a daily meal allowance of $71 per day per adult, and $36 per day per child. These amounts are based on the 2014 Federal per diem allowance for the Los Angeles area (http://www.gsa.gov/portal/category/100120). For the purposes of meal allowance calculations, a child is considered a person 12 years of age or younger. If a resident chooses to make their own

hotel arrangements, the hotel allowance is $165 per night per room, based on 2 people per room. This amount is higher than the 2014 Federal per diem allowance for the area. Additionally, an inconvenience allowance will also be provided.

If the resident has pets that will not be staying at the hotel, the resident will be given the option to board the pets at a facility selected and reserved by Cartus, or to make their own arrangements to board pets with an allowance of $30 per day per pet. Additionally, Shell will pay for updated shots if the pet is not current on vaccinations required for boarding. Shell understands that some pets have special needs, such as regular medication, that might increase the cost of boarding a pet, and will take such special needs requests under consideration when provided an explanation of the need.

Security

While residents are temporarily relocated, onsite security, consisting of an off-duty law enforcement officer, will be present at each area where active remediation work is being conducted and the residents are relocated during the hours that URS or its subcontractor personnel are not present onsite. When working on both sides of a block, a security officer will be stationed on each street. A relief officer will be present in the neighborhood to relieve the onsite officer(s) for meal and rest breaks. In the event of an emergency, including suspicious persons/activities at or near the residence, emergency services will be contacted immediately by calling 911, followed by the resident or their designated legal representative, and URS. If the situation is not an emergency, URS will be notified immediately or, if after hours, at the start of the next working day. All verbal notifications will be followed by written documentation of the incident within 24 hours; including date, time, and description of the incident; who was contacted, and time the resident or their legal representative and URS representative were notified.

Attachment A

USE OF PROPERTY AND ACKNOWLEDGMENT OF PAYMENT TO OCCUPANTS

Company and Responsible Occupants agree as follows:

Agreement: This Use of Property and Acknowledgment of Payment to Occupants

Property Address:

Responsible Occupants (Owner or Tenant):

Company: Shell Oil Company

Activities: Excavation yard of Property including hardscape, and Restoration of Property

Leave Date:

Return Date:

Excavation and Restoration Period:

Number of Days in Excavation and Restoration Period: X days

Number of Nights in Excavation and Restoration Period: X-1 nights

Number of Occupants in Home (including Responsible Occupants) and Number of Pets to be Boarded:
X Occupants 13 years and older, X Occupants 12 years and younger, and X Pets to be boarded.

Payment to Responsible Occupants: $XXX TOTAL PAYMENT AMOUNT If one or more Occupants decide to stay at the house after having asked for alternative accommodations, the amounts provided for those accommodations will be adjusted accordingly.

What Company will do: (a) Have the right to use the Property for Remediation purposes during the Excavation and Restoration Period; (b) Pay to the Responsible Occupants the Total Payment Amount; (c) Repair any damage to the Property caused by Company's use of the Property during the Excavation and Restoration Period.

What Responsible Occupants will do: (a) Have all of the Occupants and pets leave the Home on or before the Leave Date and keep all Occupants and pets away from the Property during the entire Excavation Period until the specified Return Date; (b) Allow Company to use the Property during the Period for Excavation and Restoration (even if occupant elects to return during Restoration activities); (c) Notify Company of all known hazards or risks in the Property and in the Home; (d) Comply with all Rules of Occupancy at the temporary living facility/hotel during the Occupants' stay.

No Admission of Liability: Company is not admitting to any liability relating to the Property or the Home or any environmental matter relating to the Property or the Home by signing and performing this Agreement or conducting the Excavation and Restoration.

Signed as of <Date>.

RESPONSIBLE OCCUPANTS:

_____

[Signature]

_____

[Signature]

COMPANY:

_____

[Signature]

Attachment B

Sample Resident Questionnaire for Determining Temporary Relocation Assistance

Please provide all applicable information.		
Head of Household (Select one adult to represent the family. This is the name of the person that the temporary assistance payment will be made out to or to whose account the payment will be sent):		
Primary Residence Address:		
Occupancy Basis at Primary Address:	☐ Owner	
	☐ Tenant	
	☐ Living with Friend or Family. No rent paid.	
Type of Primary Residence	☐ House	☐ Mobile Home
	☐ Apartment	☐ Other
Name and Address of Landlord/Mortgage Holder at Primary Address:		

Phone Numbers of Residents

Residence phone	
Cell phone (and name)	
Head of Household work or other #	

Occupants at Primary Address

Name	Age	Sex	Relationship to Head(s) of Household
1.			
2.			
3.			
4.			
5.			
6.			

Special Needs? (e.g., handicap accessible, special provisions for health concerns)
How many cars/trucks do you currently have that will require parking at the temporary address?

Hotel/Extended Stay Facility Needs *(Delete if not needed) (The company has ultimate discretion to determine the number of rooms needed.)*	
Number of Rooms: _____ Adjoining Rooms: ☐ No ☐ Yes Explain:	Refrigerator: ☐ No ☐ Yes Explain:

Apartment Needs *(Delete if not needed) (The company has ultimate discretion to determine the number of bedrooms needed.)*	
Number of bedrooms needed:	Other needs:

Staying with Friends or Family:	
Name and address of friend or family:	Phone number of friend or family:

Pet Needs

Do you have pets that will need to be temporarily relocated? ☐ No ☐ Yes	
How many pets and what type:	Are your pets up to date on all required shots? ☐ No ☐ Yes
Do any of your pets have unique needs? (e.g. daily medication, large aquariums, etc.) ☐ No ☐ Yes If yes, please explain:	

Transportation Needs

How do your children get to school currently?
What is the name of the school(s) your children attend:
Will your children require transportation to school from the temporary living facility? ☐ No ☐ Yes If yes, please provide details:
How far away is your workplace from your children's school(s)?
Do you have any other transportation needs?

Additional Information

Please provide any other information that you feel would be helpful in addressing your temporary living needs.

I certify that the above information is accurate and true. I understand that if any information on this form changes, I need to inform the Company. I also understand that if any information on this form is found to be inaccurate, some or all of my temporary relocation assistance may be denied or withdrawn.

Signature:_____

Printed name:_____

Date:_____